

Appendix J

ECOLOGICAL ASSESSMENT



**Cowra Heavy Vehicle Bypass REF
Terrestrial & Aquatic Ecology Impact Assessment**

November 2016

Cowra Heavy Vehicle Bypass REF Terrestrial & Aquatic Ecology Impact Assessment

29 November 2016

Prepared for:
Geolyse Pty Ltd
154 Peisley Street
PO Box 1963
Orange NSW 2800

Prepared by:
DPM Envirosciences Pty Ltd
ABN: 54 602 226 460
PO Box 1298 Mooloolaba QLD 4557
Ph: 0427 694 433

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By

DPM Envirosciences Pty Ltd

ABN: 54 602 226 460

PO Box 1298 Mooloolaba QLD 4557



David Moore

Principal Environmental Scientist

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CONTENTS

1	INTRODUCTION.....	1
1.1	Purpose	1
1.2	Scope of works	1
2	BACKGROUND.....	4
2.1	Project description	4
2.2	Regional setting	4
2.3	Hydrology and rainfall.....	5
3	LEGISLATIVE FRAMEWORK AND RELEVANT GUIDELINES.....	7
3.1	Commonwealth legislation.....	7
3.1.1	Environment Protection and Biodiversity Conservation Act 1999	7
3.2	State legislation and policy	7
3.2.1	Environmental Planning and Assessment Act 1979	7
3.2.2	Threatened Species Conservation Act 1995	7
3.2.3	National Parks and Wildlife Act 1974	8
3.2.4	State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection	8
3.2.5	Fisheries Management Act 1994	8
3.3	Relevant guidelines	9
3.3.1	Survey guidelines for Australia’s threatened fish.....	9
3.3.2	Australian River Assessment System	9
3.3.3	Water quality guidelines	9
4	METHODS	10
4.1	Study area	10
4.2	Taxonomic nomenclature	10
4.3	Determination of species significance level.....	10
4.4	Desktop assessment	10
4.5	Field survey	11
4.5.1	Survey timing	11
4.5.2	Aquatic ecology.....	12
4.5.3	Flora	17
4.5.4	Fauna	18
4.6	Assumptions and Limitations.....	19
5	EXISTING ENVIRONMENT.....	21
5.1	Vegetation communities	21
5.1.1	Pastureland and modified Grasslands.....	21
5.1.2	Yellow box woodland (on flats and terraces of the slopes).....	22
5.1.3	Floodplain Complex (Central Lachlan).....	22
5.1.4	Threatened Ecological Communities	23
5.1.5	Endangered Ecological Communities	23
5.2	Flora.....	26
5.3	Fauna.....	28
5.4	Aquatic habitat and species composition	36

5.4.1	Waterway classification	36
5.4.2	Aquatic Ecological Communities	36
5.4.3	Aquatic habitat	36
5.4.4	Macroinvertebrates	37
5.4.5	Macro-crustaceans.....	37
5.4.6	Fishes.....	37
5.4.7	Turtles	42
5.4.8	Platypus.....	42
5.5	Critical habitat	42
6	POTENTIAL IMPACTS	43
6.1	Flora.....	43
6.1.1	Vegetation removal	43
6.1.2	Threatened species and ecological communities	43
6.1.3	Weeds	43
6.2	Fauna.....	44
6.2.1	Habitat loss.....	44
6.2.2	Connectivity and habitat fragmentation.....	44
6.2.3	Threatened and migratory species	44
6.3	Aquatic ecology	45
6.3.1	Threatened aquatic species and endangered ecological community	45
7	MITIGATION MEASURES	47
8	CONCLUSION AND RECOMMENDATIONS	50
9	REFERENCES.....	52

TABLES

Table 1 AusRivAS edge habitat predictor model variables for NSW autumn sampling.....	14
Table 2 Seasonal considerations for fish survey in the Lachlan River catchment.....	16
Table 3 Fauna survey locations	18
Table 4 Threatened flora, or their habitat, identified from the search area (within 10 km of the Study area).....	27
Table 5 Threatened and migratory fauna species, or their habitat, identified from the search area (within 10 km of the Study area)	29
Table 6 Threatened fish and invertebrate species recorded from the Lachlan River catchment	39
Table 7 Flora species recorded in the Study area 27-29 April 2015.....	2
Table 8 Fauna species recorded in the Study area 27-29 April 2015.....	7

FIGURES

Figure 1 Regional location.....	3
Figure 2 Flow volume and river height for the Lachlan River at Cowra, DPI station 412002, located approximately 2 km upstream of the study reach (DPI 2014)	5
Figure 3 Historical rainfall at Cowra Airport meteorological station 65111 (BoM 2015)	6
Figure 4 Daily rainfall, minimum and maximum temperatures at the Cowra Airport meteorological station 65111 from 1 March 2015 until the end of the survey period	12
Figure 5 Project alignment and existing vegetation mapping	24
Figure 6 Survey sites and ground-truthed vegetation mapping	25
Figure 7 Bridge crossing over a watercourse (NSW Office of Water 2012)	48
Figure 8 Conceptual road crossing facilitating fish passage (NSW Office of Water 2012).....	49

PLATES

Plate 1 Northern river blackfish (<i>Gadopsis marmoratus</i>), Lachlan River, 28 April 2015.....	41
Plate 2 Mountain galaxias (<i>Galaxias olidus</i>), Lachlan River, 28 April 2015.....	41
Plate 3 Carp gudgeon (<i>Hypseleotris</i> sp.), Lachlan River, 28 April 2015.....	41

APPENDICES

Appendix A: Site Descriptions – Flora Observations
Appendix B: Site Descriptions – Fauna Habitat
Appendix C: Site Descriptions – Aquatic Assessment
Appendix D: Flora Species Detected
Appendix E: Fauna Species Detected
Appendix F: Assessments of Significance – Terrestrial Fauna
Appendix G: Assessments of Significance – Aquatic Fauna

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1 INTRODUCTION

DPM Envirosciences Pty Ltd (DPM) was commissioned by Geolyse Pty Ltd to undertake an ecological impact assessment for the proposed Cowra Heavy Vehicle Bypass (CHVB). Council is preparing a Review of Environmental Factors (REF) for the CHVB, which involves constructing a new section of road as well as the upgrade of existing roads, linking the Mid Western Highway at Campbell Street, skirting to the south of the railway and connecting to Grenfell Road via Airport Road (Figure 1).

This report describes the aquatic and terrestrial ecological values of the study area, assesses the potential impacts that may arise during construction, operation and decommissioning of the CHVB, and recommends management measures to avoid or minimise these impacts. Results discussed in this report are based on a desktop assessment of readily available information for the study area, followed by a field survey of the proposed route conducted from 27-29 April 2015.

1.1 Purpose

The purpose of this report is to identify the existing ecological values of areas that may be impacted by the CHVB, and to identify measures to avoid, minimise or mitigate potential impacts.

The report identifies existing environmental values with respect to flora, fauna and aquatic ecology including the potential occurrence of Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as well as matters listed under the NSW *Fisheries Management Act 1994* (FM Act) and NSW *Threatened Species Conservation Act 1995* (TSC Act).

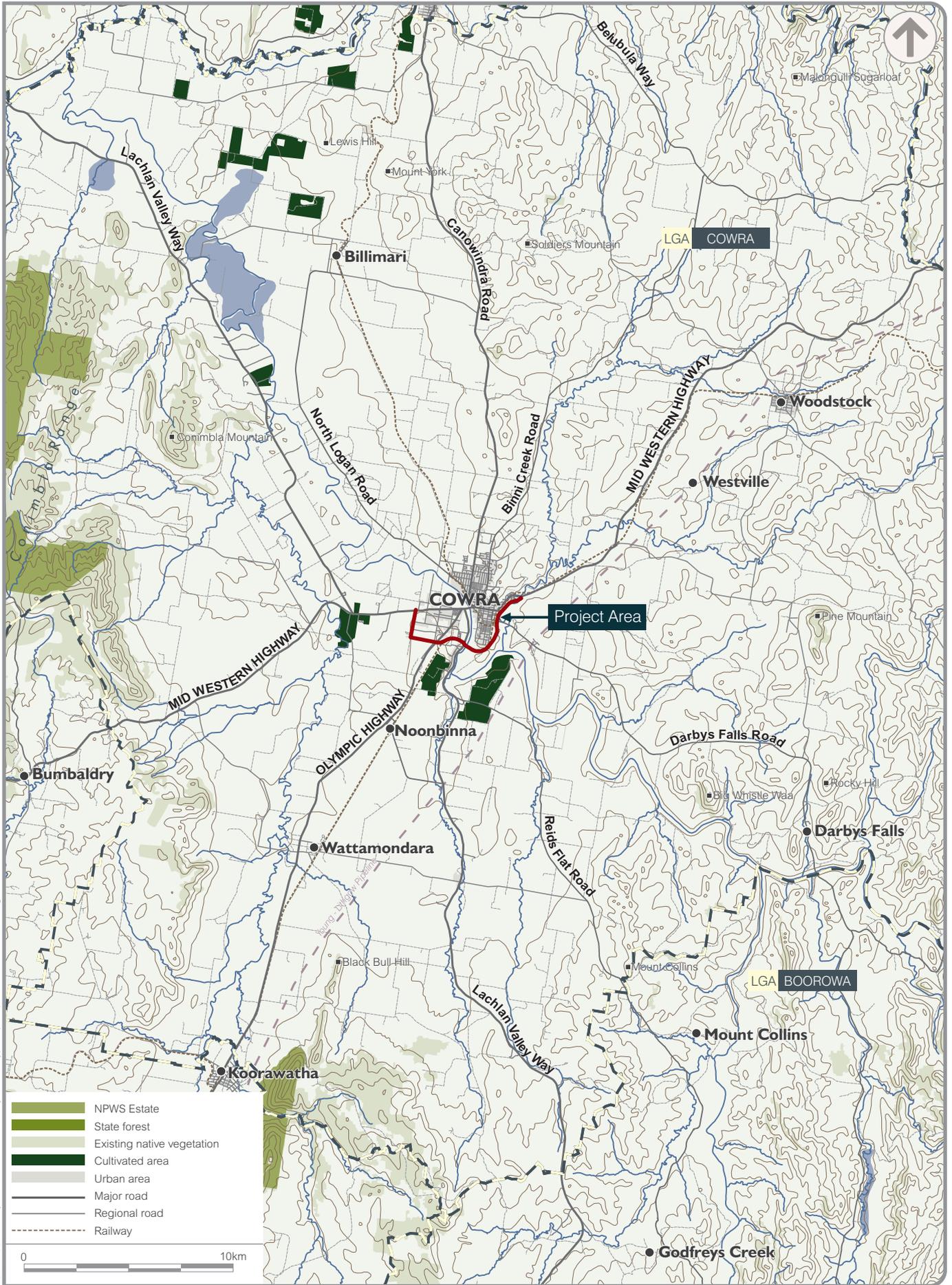
For the purposes of this assessment, the study area considered in this report is the Revision A version of the Cowra Traffic Relief Route, including the indicated pavement and batters, provided by GHD (drawings 22-16385-C005 to 22-16385-C016).

1.2 Scope of works

The scope of work for the terrestrial and aquatic ecology impact assessment for the CHVB includes:

- conduct a desktop review of available literature and previous studies in the vicinity of the study area, and conduct database searches for significant aquatic values, threatened fauna species, threatened flora species and ecological communities
- survey the study area to:
 - confirm the presence of significant aquatic values, including to:
 - describe aquatic habitats, including features such as substrate composition, stream type, water quality and surrounding land uses
 - describe aquatic flora and fauna (including aquatic invertebrates, fish, reptiles and aquatic mammals such as platypus) present or likely to be present at other times of the year
 - identify and describe listed threatened aquatic species, populations or communities, and any introduced aquatic species that are encountered or likely to be encountered in the Study area
 - identify flora species that occur and to map vegetation communities and any threatened flora species detected

- identify potential habitat for threatened fauna species.
- prepare an Ecological Impact Assessment report that identifies the methods and results of the desktop and field studies, assesses ecological impacts of the CHVB, and recommends appropriate impact mitigation measures.



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2 BACKGROUND

2.1 Project description

Council engaged GHD to undertake a route options study to identify and evaluate a number of options for heavy vehicle traffic passing through Cowra. This included route options documented in the Cowra Shire Land-use Strategy (Collie Pty Ltd 2009, cited in GHD 2013). Of ten possible routes considered, GHD (2013) recommended that Option 3, i.e. the CHVB, be adopted as the most preferable route for a heavy vehicle bypass of Cowra. At Council's meeting 22 July 2013, Council adopted the CHVB as the preferred project for the heavy vehicle bypass route.

The CHVB would link the Mid Western Highway at Campbell Street east of Cowra, skirting to the south along the unused railway and connecting to Grenfell Road via Airport Road (Figure 1). The majority of the existing alignment of Campbell Street would be utilised, although some realignment and associated land acquisitions may need to take place. The proposed alignment remains south of the disused railway alignment, crossing the Lachlan River approximately 40 m south of the disused railway bridge. A round-about would likely be installed on the Lachlan Valley Way beneath the disused railway bridge. At this location, the CHVB passes to the northern side of the disused railway, continuing west along a new section of road, aligning with a section Fishburn Street. The proposed route then follows the entirety of Boundary Road and Airport Road, connecting with Grenfell Road west of Cowra.

2.2 Regional setting

The study area falls within the Cowra Local Government Area (LGA) in the Lachlan Valley of central west New South Wales (NSW) (Figure 1). The primary land use of the Cowra LGA is dryland agriculture and plantations (2,210 km² or 79% in 2008) (ABS 2014). Conservation and natural environments represent approximately 13% (378 km² in 2008) of land use in the LGA (ABS 2014).

Waterways intersected by the proposed CHVB include the Lachlan River and Waugoola Creek. Waugoola Creek is an ephemeral waterway that drains into the Lachlan River to the south of the study area. The riparian corridor of both the Lachlan River and Waugoola Creek form part of the biodiversity corridors identified on the Terrestrial Biodiversity Map of the *Cowra Local Environmental Plan 2012*.

Regionally, the Study area forms part of the Lachlan River catchment within the greater Murray Darling Basin. The NSW Water Quality and River Flow Objectives for the Lachlan River catchment (DECCW 2006) identifies environmental values for the major regulated rivers of this catchment (including the Lachlan River within the Study area) as:

- aquatic ecosystems
- visual amenity
- recreation
- human drinking water
- water supply for livestock and irrigation
- aquatic foods.

Environmental values for waterways affected by urban development (including Waugoola Creek) include aquatic ecosystems, visual amenity and recreation (DECCW 2006).

2.3 Hydrology and rainfall

The Lachlan River at Cowra is regulated by Wyangala Dam and is not subject to seasonal extremes observed in some other natural drainages of the Murray Darling Basin. It is characterised by semi-permanent flow, with generally more water released from Wyangala Dam in winter and spring, including peak volumes and river heights in August and September respectively (Figure 2). It is expected that the Lachlan River reach intersected by the proposed CHVB provides habitat and passage for fish and other aquatic biota almost year round, with species composition and activity influenced by water releases from Wyangala Dam, as well as natural breeding cues.

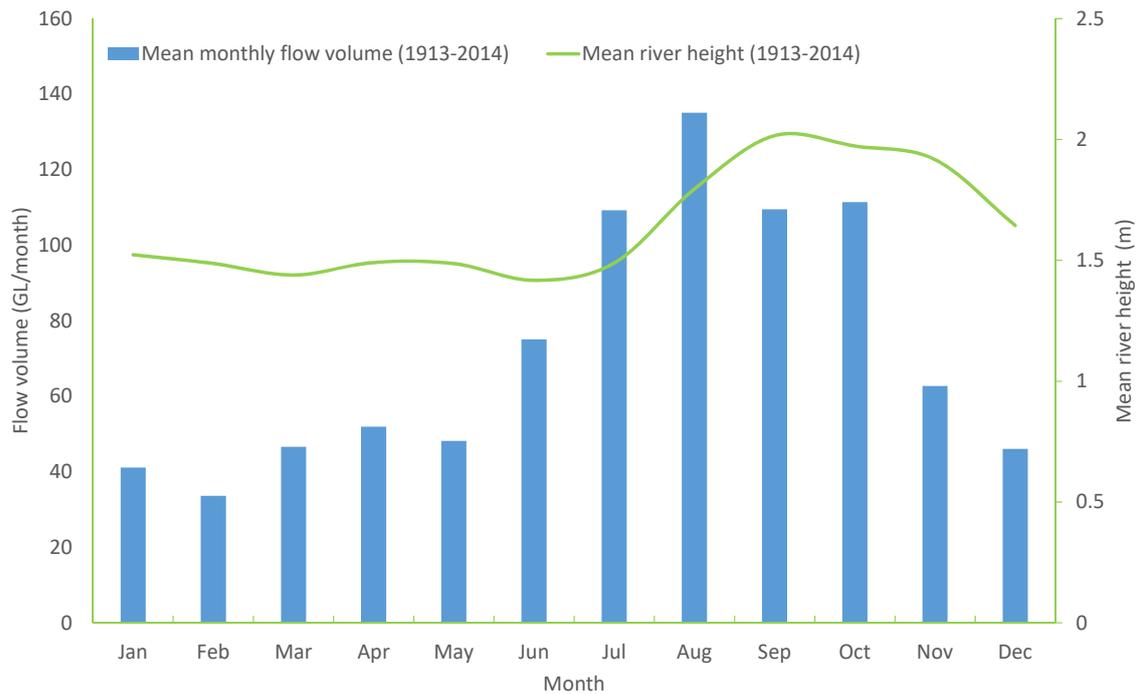


Figure 2 Flow volume and river height for the Lachlan River at Cowra, DPI station 412002, located approximately 2 km upstream of the study reach (DPI 2014)

Waugoola Creek is ephemeral and expected to experience flow only after sustained or intense rainfall in the catchment. Stream flows are expected to be highly variable, with no obvious seasonal trends in rainfall (Figure 3). When flows subside, aquatic fauna are likely to concentrate in senescing pools. As a consequence, physical attributes, water quality, and the composition of aquatic floral and faunal communities are expected to be highly variable over time.

The proposed river crossing is located approximately 48 km downstream of Wyangala Dam, which acts as a barrier to fish migration and also contributes thermal pollution. Releases from the hypolimnion of Wyangala Dam via the fixed-level intakes are known to depress water temperatures by up to 7 °C, the effects of which may persist 170 to 400 km downstream (DIPNR 2004).

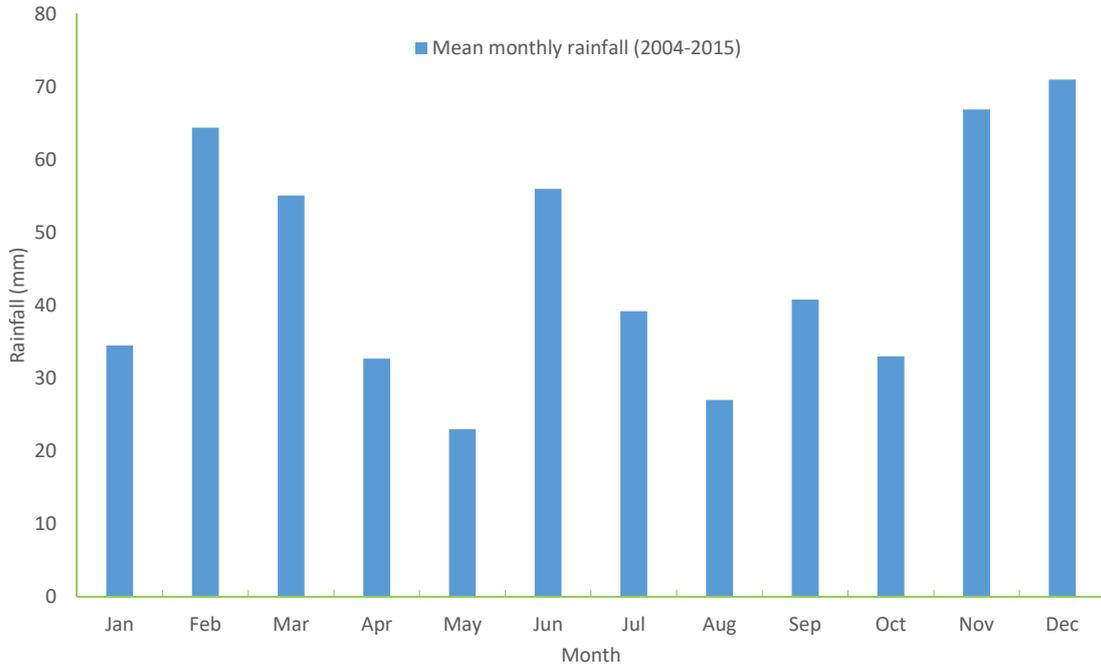


Figure 3 Historical rainfall at Cowra Airport meteorological station 65111 (BoM 2015)

3 LEGISLATIVE FRAMEWORK AND RELEVANT GUIDELINES

3.1 Commonwealth legislation

3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the Department of the Environment (DoE) and regulates any action that will, or is likely to, have an impact on any Matter of National Environmental Significance (MNES). MNES relevant to biodiversity include:

- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas.

Pursuant to the EPBC Act, a person must not undertake any action that will have, or is likely to have, a significant impact on any MNES. According to the MNES Significant Impact Guidelines 1.1 (DoE 2013), a significant impact is an impact which is important, notable or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. A significant impact is considered likely if it is real or does not have a remote chance or possibility.

MNES have been considered in Section 5. A referral to the DoE is not required as part of the works.

3.2 State legislation and policy

3.2.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) provide the framework for environmental planning in NSW and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed environmental assessment.

The CHVB is an activity being assessed under Part 5 of the EP&A Act. This ecological assessment forms part of an REF for the activity and examines the significance of likely ecological impacts of the CHVB and the measures required to mitigate any adverse impacts to terrestrial and aquatic ecosystems.

3.2.2 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act 1995* (TSC Act) provides for the conservation of threatened species, populations and ecological communities of plants and animals. It provides a framework to ensure that the impact of any action affecting threatened species is assessed. Schedule 1 of the TSC Act lists endangered species, populations and ecological communities; Schedule 2 lists vulnerable species; and Schedule 3 lists key threatening processes. Part 3 of the TSC Act defines critical habitat.

This ecological assessment considers the potential impacts to all threatened species, populations and communities listed under the TSC Act that are known or considered likely to occur within the study area.

The impact of the CHVB on species listed in the TSC Act is discussed in Sections 5.2 and 5.3. The review of relevant literature and database searches identified that a number of flora and fauna species and endangered ecological communities (Section 5.1.5) are known to occur within the desktop search area. However, the assessments concluded that no threatened flora or fauna species, populations or ecological communities listed under the TSC Act were found to make substantial use of the CHVB route and no significant impacts are considered likely to occur as a result of the CHVB.

3.2.3 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1974* (NP&W Act) governs the establishment, preservation and management of national parks, historic sites, and the protection of certain fauna, native plants and Aboriginal relics.

Under the NP&W Act all fauna is protected, threatened or otherwise. Schedule 13 of the NP&W Act lists protected plants, which shall not be harmed or picked on any land either on or off National Park estate without prior approval.

3.2.4 State Environmental Planning Policy No. 44 (SEPP 44) – Koala Habitat Protection

The NSW *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44) under the EP&A Act aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.

The Cowra LGA is not listed in Schedule 1 of the SEPP 44. As such, this SEPP does not apply to the CHVB.

3.2.5 Fisheries Management Act 1994

The NSW *Fisheries Management Act 1994* (FM Act) and its regulations are relevant to aquatic habitat and fauna that may be affected by the CHVB. The FM Act lists threatened aquatic species, populations and ecological communities under Schedules 4, 4A and 5, respectively. Schedule 6 lists key threatening processes.

This ecological assessment considers the potential impacts to those threatened species, populations and communities listed under the FM Act that are known or considered likely to occur within the study area.

Activities that trigger the requirement for Council to notify the Minister for Fisheries include:

- dredging or reclamation of waterways, including removal of snags or aquatic vegetation (28 days notification) under Sections 198 and 200
- temporary or permanent blockage of fish passage requires a permit under Section 219.

The classification of waterways in the study area was carried out in general accordance with the policy and guidelines for fish habitat conservation and management (DPI 2013). The assessment of ecological impacts assumed that any waterway crossing would be designed and built to comply with this policy.

3.3 Relevant guidelines

3.3.1 Survey guidelines for Australia's threatened fish

The Survey guidelines for Australia's threatened fish (DSEWPaC 2011) provide a guide to surveying threatened fishes listed in the EPBC Act. The desktop review identified the potential for a number of EPBC Act listed species to occur within the Lachlan River in the vicinity of the proposed CHVB crossing (Section 5.4.6). These guidelines assist researchers in determining the best methods and windows of opportunity to detect threatened fishes, whilst avoiding key periods of sensitivity such as spawning. These guidelines are referred to in Table 2.

3.3.2 Australian River Assessment System

The NSW Australian River Assessment System (AusRivAS) protocols (DEC 2004) were followed during the planning, collection and assessment of aquatic macroinvertebrate samples and aquatic habitat data. Sampling was conducted in the autumn sampling season, which extends from mid-March to mid-June.

Macroinvertebrate samples were collected using the NSW AusRivAS protocols. AusRivAS models were accessed to aid in interpretation of results and in determining the health and integrity of macroinvertebrate communities relative to reference sites in the broader region. The NSW AusRivAS field sampling sheets were used for habitat assessments. In addition, longitudinal and cross-sectional profile sketches were obtained to capture a snapshot of stream dimensions at the proposed CHVB crossing of the Lachlan River.

3.3.3 Water quality guidelines

Where available, local water quality guidelines take precedence over state and national guidelines, which are more generic in nature. Local water quality guidelines were referenced to provide context for physico-chemical water quality measurements obtained during the site visit.

The most appropriate water quality guidelines for the Lachlan River in the study area are the Lachlan River Water Quality Objectives (EPA 2006) for 'aquatic ecosystems' in the 'major regulated rivers'. These guidelines are identified in Section 5.4.3.

4 METHODS

4.1 Study area

The study area considered in this report is the Revision A version of the Cowra Traffic Relief Route, including the indicated pavement and batters, provided by GHD (drawings 22-16385-C005 to 22-16385-C016) (Figure 6).

4.2 Taxonomic nomenclature

Scientific names of fauna used in this report follow the CSIRO List of Australian Vertebrates (Clayton et al. 2006). Scientific names of flora used in this report follow the Australian Plant Census (CHAH 2015).

4.3 Determination of species significance level

The significance of vegetation communities is described as per their listings in the EPBC Act and/or TSC Act as Critically Endangered, Endangered or Vulnerable.

Listed threatened flora and fauna species are defined as those taxa listed in the EPBC Act, TSC Act or the FM Act as Critically Endangered (CE), Endangered (E) or Vulnerable (V).

4.4 Desktop assessment

Desktop searches were undertaken in February 2015 to identify known terrestrial and aquatic ecological values of the study area and surrounds. This included a review of the following:

- DotE EPBC Act Protected Matters Search Tool, to identify MNES within approximately 10 km of the CHVB. The search area was defined by the GDA 1994 coordinates:
 - -33.73755; 148.82072
 - -33.94507; 148.82072
 - -33.94507; 148.54308
 - -33.73755; 148.54308
- NSW BioNet, to identify threatened flora and fauna records within approximately 10 km of the CHVB. The search area was defined by the GDA 1994 coordinates:
 - -33.74; 148.82
 - -33.95; 148.82
 - -33.95; 148.54
 - -33.74; 148.54
- Department of Primary Industries (DPI) Records Viewer to identify threatened fish species records for the Lachlan River catchment
- Fish distribution maps in *Fishes of the Murray-Darling Basin: An introductory guide* (Lintermans 2007) and *Field guide to the freshwater fishes of Australia* (Allen et al. 2002)
- Murray-Darling Basin Authority Sustainable Rivers Audit 2: The ecological health of rivers in the Murray-Darling Basin at the end of the Millennium Drought (2008-2010)
- DotE EPBC Act Species Profiles and Threats Database (SPRAT)
- Office of Environment and Heritage Threatened Species Profiles

- DPI Noxious Weed database to identify noxious weeds declared for the Cowra Local Government Area
- Cowra Heavy Vehicle Bypass Study Draft Report (GHD 2013).

4.5 Field survey

Desktop investigations were used to plan targeted field surveys. Field assessments for fauna focussed on areas of better habitat value, such as potential habitat for threatened species, watercourses and areas with the best habitat connectivity. Furthermore, the majority of the proposed CHVB route was traversed on foot. Sections of the route falling within the private property were observed from the property boundary.

4.5.1 Survey timing

The ecological survey was conducted during autumn from 27-29 April 2015.

Aquatic ecology

The Lachlan River study reach selected for the aquatic survey comprised a 300 m reach centred on the location of the proposed CHVB crossing. This area was surveyed from 27-28 April 2015, falling within the AusRivAS autumn sampling season (mid-March to mid-June). The Lachlan River at Cowra is regulated by Wyangala Dam and is not subject to seasonal extremes observed in some natural rivers of the Murray Darling Basin. Therefore, field surveys in only one season were considered sufficient for the purposes of characterising aquatic ecological values. Nonetheless, sampling again in the spring sampling season (mid-September to mid-December) may help to characterise seasonal differences in habitat and species compositions. Although, this variation has been inferred based on habitat suitability and application of the precautionary principle.

Terrestrial ecology

Conditions at the time of survey were cool (Figure 4). Moderate rainfall in the weeks leading up to the survey resulted in isolated pools of water in Waugoola Creek. The mean minimum and maximum temperatures during the three days of survey were 5.4 °C and 18.1 °C, respectively. These conditions were adequate for surveying a broad representation of fauna, with a focus on habitat attributes to infer habitat potential throughout an entire year.

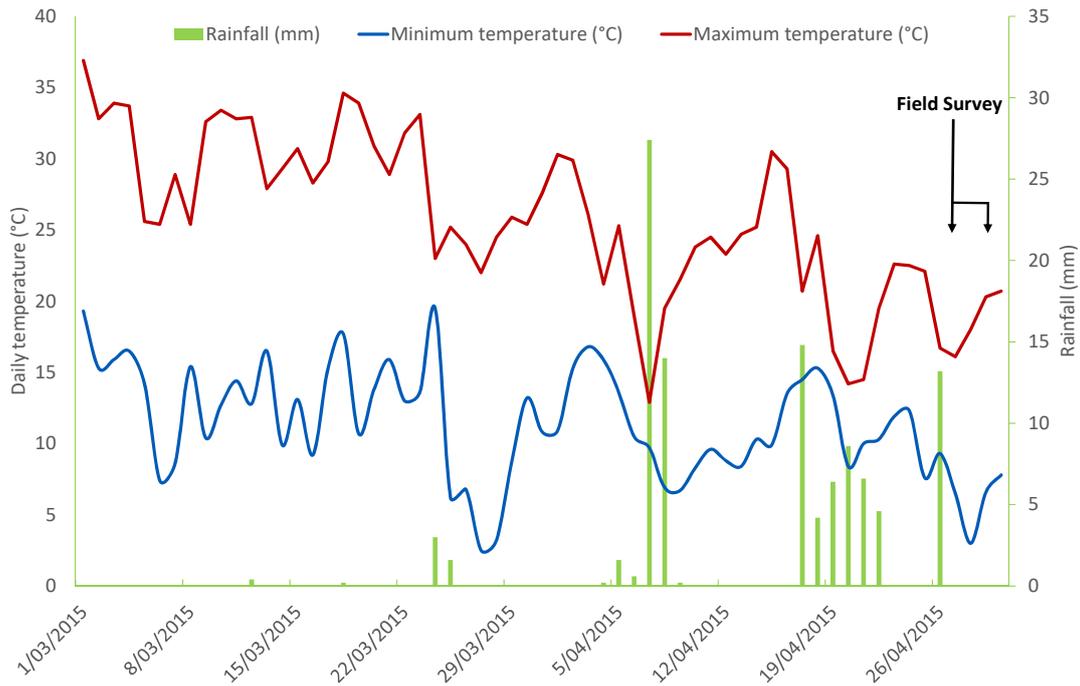


Figure 4 Daily rainfall, minimum and maximum temperatures at the Cowra Airport meteorological station 65111 from 1 March 2015 until the end of the survey period

4.5.2 Aquatic ecology

Aquatic habitat attributes

Aquatic habitat attributes were described in accordance with AusRivAS protocols for NSW streams (DEC 2004). This established a general description of the study reach and its immediate surrounds including topography, water level, shading, riparian vegetation composition, land use, stream width, depth, substrate composition and relative abundance, as well as a visual assessment of disturbance related to human activities.

A detailed description of the aquatic habitat encountered is provided as a site profile in Appendix C.

Water quality

In-situ physico-chemical water quality parameters were measured using a YSI Professional Plus multi-parameter water quality meter and Hach Turbidimeter 2100Q, each calibrated both prior to and following sampling. Alkalinity was measured in the field by acid titration. Water quality parameters measured included:

- temperature
- pH
- electrical conductivity
- turbidity
- dissolved oxygen
- alkalinity.

Aquatic flora

Aquatic plants were surveyed along the 300 m study reach of the Lachlan River. All aquatic plant specimens collected were identified using available literature and taxonomic keys. The abundance of each species in the study reach was estimated using the categories: extensive (>75% cover), moderate (50-75%), some (10-50%) or little (1-10%).

Macroinvertebrates

Macroinvertebrate samples were collected from the 300 m study reach of the Lachlan River by an AusRivAS accredited ecologist following AusRivAS protocols for NSW streams (DEC 2004). AusRivAS specifies a standardised, qualitative, rapid bioassessment method that aims to consistently sample a wide diversity of macroinvertebrates within a defined timeframe.

A standard sized dip net with 250 µm mesh was used. No riffle habitat was available to sample, so macroinvertebrates were collected from the edge habitat only. The edge habitat is the area along the creek bank with little or no flow, including alcoves and backwaters. Edge samples were obtained by sweeping a dip-net amongst the vegetation of the bank in an upstream direction over an aggregate distance of 10 m. Representative sub-habitats were targeted and included tree roots, overhanging banks, trailing vegetation, mud banks, macrophyte stands, logs and patches of leaf and woody debris.

Following collection, the sample was transferred to a plastic sorting tray, where contents were sorted, and macroinvertebrates live-picked in accordance with AusRivAS protocols. Picked specimens were placed into a sorting jar and preserved with 70% ethanol.

Samples were identified in the laboratory under stereomicroscope. Taxonomic identification was to Family level, with the exception of any Oligochaeta (to class), Polychaeta (to class), Ostracoda (to subclass), Nematoda (to phylum), Nemertea (to phylum), Acarina (to order) and Chironomidae (to subfamily), following NSW AusRivAS protocols (DEC 2004).

Data analysis

Macroinvertebrate data were used to calculate a number of community descriptors.

Taxonomic richness

Taxonomic richness was calculated from the number of taxa present in each sample, providing an indication of community diversity at the site, with richness typically increasing with ecological condition. Taxonomic richness was compared to that of similar sites sampled in the 'slopes' zone of the Lachlan Valley in the second Sustainable Rivers Audit (MDBA 2012).

PET

The PET (Plecoptera, Ephemeroptera and Trichoptera) richness was calculated from the number of taxa belonging to the three PET orders. These three orders are widely accepted as being most sensitive to environmental change, such as habitat degradation and pollution (EHP 2009). A low PET richness score suggests the site may be impacted by degradation or pollution, due to the absence of these pollution-sensitive taxa. Conversely, a high PET richness suggests a system free from degradation or pollution.

SIGNAL2

SIGNAL2 (Stream Invertebrate Grade Number – Average Level Version 2) indices were calculated at each site, with each taxon allocated a score from 1 to 10 following Chessman (2003). Taxa with a low score are most tolerant to a range of environmental conditions, and those with a high score are more sensitive to pollution. The presence / absence data of each taxon were used to calculate the SIGNAL2 average for the site in accordance with the protocols described by Chessman (2003).

Tolerant taxa

The percentage of tolerant taxa was calculated using the SIGNAL2 sensitivity grades derived for aquatic macroinvertebrate taxa at a Family level. Tolerant taxa are classified as those with a SIGNAL2 sensitivity score of 4 or less. Families in this group are expected to be able to tolerate changes to their environment, including habitat degradation and some pollution. Other taxa could be considered as sensitive (SIGNAL2 grades of 5 to 7) and highly sensitive (SIGNAL2 grades of 8 to 10). The absence of these more sensitive taxa groups generally indicates harsh environmental conditions through unfavourable habitat or a reduction in water quality.

AusRivAS

The macroinvertebrate and predictor variables (habitat) data were analysed using the AusRivAS macroinvertebrate predictive modelling program, version 3.2.0 (Ransom and Blackman 2003). The following model was used, based on location, date and habitat sampled (Table 1).

Table 1 AusRivAS edge habitat predictor model variables for NSW autumn sampling

Code	Description	Input value
ALKALINITY	Total carbonates (mg/L)	90
ALTITUDE	Height above sea level (mAHD)	287
BEDROCK	Percent bedrock in habitat (%)	0
BOULDER	Percent boulder (>256mm) in habitat (%)	0
COBBLE	Percent cobble (64-256mm) in habitat (%)	0
LATITUDE	Latitude of site – decimal degrees to 4 dp	-33.8507
LOGDFSM	Log 10 x distance from source (log 10[m])	5.45
LOGSLOPE 1KUS	Log 10 x slope: Elevation difference in metres between the middle of the site and a point 1km upstream (log 10[m])	0.30
LONGITUDE	Longitude of site – decimal degrees to 4 dp	148.6822
RAINFALL	Mean annual rainfall	510

Macro-crustaceans

Macro-crustaceans were collected as by-catch using fish sampling techniques (see fish methods below). Additionally, macro-crustacean specimens collected during macroinvertebrate sampling were retained for identification. All macro-crustaceans collected using fishing apparatus were returned to the water following identification. Identifications were undertaken to species level (where possible).

Fish

The Survey Guideline for Australia's Threatened Fish (DoE 2011), and other relevant references were considered in order to identify the most appropriate time to survey for those threatened fish species with the potential to occur in the broader Lachlan River catchment (Table 2). This includes avoiding fish survey, where possible, during known breeding periods for threatened fish species in order to minimise disturbance.

Fish were surveyed using a combination of active and passive survey techniques, including:

- Backpack electrofishing – using a Smith-Root LR-24 electrofisher for 1200 seconds power-on time (100Hz frequency; 20% duty cycle; 300-400v varied).
- Fyke nets – two dual-winged nets set horizontally across the bed to capture fish, macro-crustaceans, and potentially turtles and platypus. Fyke nets were deployed for only four hours as per Animal Ethics Committee requirements).
- Bait traps – five baited box traps were set overnight, typically aimed to capture smaller fish and macro-crustaceans.

Captured fish were identified and released at the point of capture. No introduced fish were captured and therefore no fish were euthanized.

Table 2 Seasonal considerations for fish survey in the Lachlan River catchment

Common name	Scientific name	Status		Breeding season considerations	Month														
		FM Act	EPBC Act		J	F	M	A	M	J	J	A	S	O	N	D			
Olive Perchlet (western population)	<i>Ambassis agassizii</i>	E		Spawning occurs November to December (NSW DPI 2005); preference is to avoid this period.															
Silver perch	<i>Bidyanus bidyanus</i>	V	CE	Spawning occurs in in spring or summer (TSSC 2013); preference is to avoid survey during this period.															
Flat-headed galaxias	<i>Galaxias rostratus</i>	CE		Spawning occurs in spring; however, considered locally extinct in the Lachlan River (NSW DPI 2005).															
Trout cod	<i>Maccullochella macquariensis</i>	E	E	Avoid spawning period of spring and sometimes into early summer (SEWPaC 2011).															
Murray cod	<i>Maccullochella peelii</i>		V	Survey between March and August; not in September to December (SEWPaC 2011).															
Macquarie perch	<i>Macquaria australasica</i>	E	E	Survey between February and April (SEWPaC 2011).															
Purple-spotted gudgeon	<i>Mogurnda adspersa</i>	E		No restriction.															
Southern pygmy perch	<i>Nannoperca australis</i>	E		Breeding September to January, in response to rising water temperatures (NSW DPI 2005).															
Eel-tailed catfish (MDB population)	<i>Tandanus tandanus</i>	E		Spawning occurs spring and summer (Lintermans 2007), so preference will be to avoid survey during this period.															

Note:

CE = Critically Endangered; E = Endangered; V = Vulnerable; LC = Least Concern.

Turtles

Cathedral traps could not be deployed due to unsuitable flow conditions encountered (ie pools of sufficient depth exhibited high water velocities and areas of low water velocity were too shallow to deploy cathedral traps). Turtles were targeted by visual observation and by deployment of fyke nets in shallow areas.

Platypus

Habitat assessment for platypus was undertaken for the Lachlan River study reach and included:

- description of the key aquatic habitat attributes and suitability to support platypus
- searches for the presence of platypus burrows in banks, including burrows just above the water level, typically located under a tangle of tree roots, frequently distinguishable from other holes in the bank by a horizontally oval cross-section
- noting the soil or sediment type and coherence – eg bedrock or single grain apedal soils are not suitable for burrow construction and indicate likely absence of burrows.

4.5.3 Flora

Vegetation communities

Vegetation community boundaries were assessed using the Broad Vegetation Groups identified in the Combined Extant Vegetation for the Central West Catchment (CWLach08_VIS_3813) vegetation mapping (OEH 2008) (Figure 5). Available aerial imagery and field assessment results were used to refine the vegetation mapping (Figure 6).

Field survey locations are subject to standard handheld GPS device inaccuracies (approximately 10 m).

Survey locations

Flora was surveyed along the accessible length of the proposed CHVB. This comprised the majority of the proposed route, excluding private property in the vicinity of chainages CH2600 to CH2900 and CH7500 to CH7850 (Figure 6).

Dedicated flora survey / vegetation assessment was undertaken at four sites within representative vegetation communities, capturing floristic and structural information at the site, including:

- evaluating the vegetation mapping
- identifying the dominant and characteristic canopy, midstorey and understorey species (relative abundance measured as dominant, abundant, frequent, occasional, or rare)
- field-assessed vegetation community
- patch size, connectivity and shape
- geology and soil characteristics
- condition of vegetation (based on disturbance present at the site)
- presence, population and characteristics of threatened flora
- presence of noxious and environmental weeds

- other notes relevant to the survey, such as sites features (gullies), community characteristics (size of community) or disturbances evident.

Dedicated flora survey sites are identified in Figure 6 and summarised in Appendix A.

Flora species were recorded for each assessment site, as well as whilst traversing the accessible length of the proposed CHVB route. This included targeted searches for threatened flora species identified in Table 4. A list of flora observed along the accessible length of the proposed Southern Ring Road is provided as Appendix D.

Where important species (i.e. characteristic species or potential threatened species) could not be identified in the field, samples were collected and pressed for subsequent identification.

4.5.4 Fauna

Fauna was opportunistically surveyed along the accessible length of the proposed CHVB route. This comprised the majority of the proposed route, excluding private property in the vicinity of CH2600 to CH2900 and CH7500 to CH7850 (Figure 5).

Dedicated fauna survey and habitat assessments were undertaken at four sites. Table 3 identifies the survey sites and methods used at each site. The locations of dedicated fauna survey sites are shown in Figure 6.

Table 3 Fauna survey locations

Survey site number	Description	Survey method
FA1	Waugoola Creek. Mapped as Yellow Box Woodland (Figure 5). Ground-truthed as Non-remnant.	Habitat assessment and diurnal search.
FA2	Reserve between Campbell St and the railway line. Mapped as Yellow Box Woodland. Ground-truthed as Yellow Box Woodland.	Habitat assessment, diurnal search, morning chorus bird survey, spotlighting, ultrasonic bat detection.
FA3	Lachlan River riparian corridor. Mapped as Floodplain Complex. Ground-truthed as Floodplain Complex.	Habitat assessment, diurnal search, morning chorus bird survey, spotlighting, ultrasonic bat detection.
FA4	Road corridor 70 m east of Airport Rd / Boundary Rd intersection. Mapped as Non-remnant. Ground-truthed as Non-remnant.	Habitat assessment and diurnal search.

Habitat assessment

Fauna habitat assessments were conducted at each fauna survey site (Table 3) to assess the potential for threatened fauna species. At each site a 100 m x 100 m quadrat was assessed for a range of features including:

- overall condition (pristine, very good, good, average, poor, degraded, or completely degraded)
- level of erosion (absent, scattered, frequent)
- abundance of weeds (absent, scattered, frequent)
- presence and type of disturbance (grazing etc.)

- abundance (absent, scattered, common, abundant) of:
 - large hollows (>20 cm)
 - small hollows (<20cm)
 - large logs (>50 cm diameter)
 - small logs (<50cm diameter)
 - cliffs and rocky outcrops
 - large rocks (>30 cm)
 - small rocks (<30 cm)
 - leaf litter
 - dense grass/shrub shelter
 - arboreal and terrestrial termite mounds
 - seeding grass cover
 - fruiting plants
 - nectar and pollen producing plants
 - koala food trees.

Other important habitat features, such as caves, creek banks, connectivity etc., were also noted where detected. Photos were obtained at each site (Appendix B).

Bird surveys

Bird surveys (vocalisations and sightings) were undertaken for two mornings at each site. Surveys were conducted for 0.5 person hours using the random meander survey technique.

Diurnal searches

At least 0.5 person hours was spent at each site hand searching for cryptic ground fauna, including raking of leaf litter, opening or turning over of deadfall timber and turning over rocks and other debris.

Ultrasonic bat detection

One ANABAT detector was placed at each site for one night. Where possible, the detector was placed near existing water bodies or other likely bat habitat, to increase the chance of obtaining bat recordings. These results were analysed on completion of the survey.

Opportunistic records

Any fauna heard or observed during the surveys were recorded along with signs of animals (scats, bones, tracks, scratches, diggings etc.).

4.6 Assumptions and Limitations

The information presented in this report is subject to the following assumptions and limitations:

- This report includes a desktop assessment of readily available information. Consequently, the impact assessment relies upon the accuracy of field data collected by other parties referenced in this document.

- This report assesses the proposed impact footprint identified in Revision A of the Cowra Traffic Relief Route (GHD 2012), including the indicated pavement and batters in drawings 22-16385-C005 to 22-16385-C016.
- Some of the databases used to obtain information for this report have caveats regarding the completeness of data they contain. For example, the Atlas of NSW Wildlife database is based only on recorded sightings of species, and therefore the absence of a species record in a search area does not necessarily imply that the species does not occur.
- Data from the DotE EPBC Protected Matters Search website are based on actual records, primarily from State Government databases, combined with modelled distributions of species according to their ecological characteristics. Species identified by this search may occur in the study area, but require further investigation to confirm their presence.
- As the presence or otherwise of a particular fauna species within the site can only be confirmed by detailed targeted field surveys, the precautionary principle has been adopted throughout this assessment. A species is considered likely to occur in the study area if it was recorded in database searches for the region and vegetation mapping and/or field surveys indicated that potential habitat for the species is present, based on existing knowledge of the species' ecological requirements.
- This survey was only conducted in one season and may have missed some species inhabiting the area which were not active in autumn.
- aquatic surveys were undertaken in only one season, being the AusRivAS autumn sampling season (mid-March to mid-June). Although sampling again in the spring (mid-September to mid-December) may help characterise seasonal differences in habitat and species compositions, this variation can be inferred based on habitat suitability and application of the precautionary principle to the impact assessment.

5 EXISTING ENVIRONMENT

5.1 Vegetation communities

The study area is flanked by broad open grazed and cropped farmlands, and partially by an urban fringe with its associated roads and infrastructure. Agricultural and roadside management practices have impacted and influenced the vegetation across the study area and have substantially removed much of the native composition and floristic structure from the landscape.

The study area is strongly dominated by agricultural pasturelands and associated grasslands. Small patches and narrow corridors of Yellow Box (*Eucalyptus melliodora*) Woodland are the remnants of original box-gum woodland of the area (Figure 6). The Lachlan River riparian corridor is vegetated with Floodplain Complex which has also been significantly cleared and confined by the prior land-use history of the locality.

5.1.1 Pastureland and modified Grasslands

A substantial length of the proposed CHVB is comprised of modified grasslands and pastureland derived from a history of agricultural use and infrastructure development across the study area.

Pastureland within the study area is fenced and heavily grazed. It is largely devoid of native flora species, instead being dominated by pasture species or cereal crops. Trees are widely spaced and consist of mature or old aged individuals. Tree species are representative of the original parent eucalypt communities with the exception of planted tree-lots and feature vegetation. Native midstorey and shrub stratum are absent. African boxthorn (*Lycium ferocissimum*) is common and occurs frequently as thickets under isolated paddock trees. Groundcover on grazed pastureland consists of species common to improved pasture or rotational cropping regimes. Lower lying areas contain loosely scattered stands of robust sedge tussocks.

The modified grasslands of the study area range from highly disturbed and weedy sites to disused and isolated easements where the derived grassland contains a relatively high proportion of native groundcover.

Roadside easements are composed mainly of short groundcover, maintained with slashing and weed suppression. Groundcover is comprised of common robust native grasses and a variety of pasture associated species. Along urban road edges and street verges, much of the streetscape has been mown to fence-lines or property boundaries. Shrub and tree species include a variety of native and exotic conventional landscaping varieties.

The streetscape of Boundary Road is dominated by an avenue of mixed native tree and shrub species (many endemic) lining property frontages either side of the road. Groundcover is mown short. These plantings are estimate to range from approximately 10 to 25 years of age.

The streetscape of Airport road comprises of an avenue of mugga ironbark (*Eucalyptus sideroxylon*) interspersed with occasional box-eucalypt species lining either side of the road.

The disused railway easement contains an ungrazed grassland community with a more diverse groundcover comprised of common native species interspersed with exotics and weed species. Poorly drained areas, culverts and low-lying depressions are vegetated by tall stands of moisture-associated species such as sedges, couch grass (*Cynodon dactylon*), curled dock (*Rumex crispus*), phalaris (*Phalaris aquatica*) and variegated thistle (*Silybum marianum*). The dumping of garden refuse and household rubbish was observed in the rail easement and in adjacent vacant land.. Much of this area has been subject to prior earthworks, compaction or

past erosion and, as a consequence, contains a high composition of exotic species. Areas where these disturbances have been lessened contain a greater diversity of native understorey species. In these areas, the native component typically includes robust and prolific species including kangaroo grass (*Themeda australis*), redanther wallaby grass (*Rytidosperma pallidum*), snowgrass (*Poa sieberiana*), hairy panic (*Panicum effusum*), and curly windmill grass (*Enteropogon acicularis*). Trees are largely absent and consist of isolated eucalypts and exotics such as pepper tree (*Schinus areira*), *Prunus* spp., crack willow (*Salix fragilis*), black willow (*Salix nigra*) and poplar (*Populus alba*).

5.1.2 Yellow box woodland (on flats and terraces of the slopes)

Remnant mature-aged trees are indicative of parent communities of the study area and surrounds. Mature yellow box in association with other local eucalypt species suggest that much of the broad creek and riverside flats and lower-lying terraces of the landscape were originally vegetated with open box woodland.

The agricultural history of much of the study area has removed almost all of the parent native communities from the landscape. Less arable land such as rises and poorly drained sites, creek lines and drainage channels retain small remnants of native timber. Associated species include grey box (*E. microcarpa*), Blakely's red gum (*E. blakelyi*), and occasional river red gum (*E. camaldulensis*) occurring in locations closer to the Lachlan River. The native shrub layer of this community is absent due to grazing impact. African boxthorn occurs as large clumps under mature trees.

Groundcover diversity is consistent with that recorded within open pastureland and roadside easements.

The native tree age structure tends to be skewed toward older mature trees. Regrowth is absent from areas where grazing stock have access. Natural regeneration is not occurring over much of the site. It is likely that strong competition by dense groundcover species would limit any shrub or tree species recruitment.

No defined corridors or significant islands of woodland were identified. A small and isolated remnant of box-eucalypt dominated woodland is present west of CH5700 to CH6000 between Campbell Street and the railway easement (Figure 6). Lower slopes of this rise support an open yellow box woodland community, transitioning into a small remnant of grey box – black cypress pine (*Callitris endlicheri*) remnant on elevated ground. This remnant area would not be impacted by the CHVB.

5.1.3 Floodplain Complex (Central Lachlan)

The riparian corridor along the Lachlan River is a narrow remnant of the original river red gum forest characteristic of river margins in the broader Murray Darling Basin. The corridor is now restricted largely to the river banks, rarely extending on to the floodplain. The river red gum dominated galleries are heavily infested with willows (*Salix* spp.) and the herbaceous understorey is dominated by exotics. The width of the Lachlan River riparian corridor (including the channel) in the 300 m study reach is less than 100 m wide. Remnant eucalypts and river she-oak (*Casuarina cunninghamiana*) form a very narrow gallery on either bank with willows comprising a dense and clumped lower stratum. Some native tree recruitment is occurring and away from canopy cover, ground cover is moderately dense.

Weed species and exotics dominate the ground and midstorey strata. Blackberry (*Rubus ulmifolius*) is present in many locations along with dense variegated thistle (*Silybum marianum*), purpletop (*Verbena bonariensis*), water couch (*Paspalum distichum*), ribwort (*Plantago*

lanceolata) and bedstraw (*Galium* sp.). Occasional garden escapees also occur amongst the upper-bank vegetation.

Past impacts to the subject site within this community have been varied. Historical disturbance is evident from old bridge pylons and structures. The existing railway bridge is located immediately north of the site and numerous tracks and dumping sites are present on the upper banks.

5.1.4 Threatened Ecological Communities

The EPBC Act Protected Matters Search Tool (DotE 2015) identifies two EPBC Act listed Threatened Ecological Communities (TEC) as likely to occur within the search area. These are:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Although a number of constituent species occur within the study area, no vegetation communities were detected that meet the definition of either of these TECs.

5.1.5 Endangered Ecological Communities

The Atlas of NSW Wildlife (OEH 2015a) identifies three Endangered Ecological Communities (EECs) as occurring within the search area. These are:

- Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions
- Inland Grey Box Woodland in the Riverine, NSW South Western Slopes, Cobar Penplain, Nandewar and Brigalow Belt South Bioregions
- White Box Yellow Box Blakely's Red Gum Woodland.

Although a number of constituent species of these EECs occur within the study area, no vegetation communities were detected that meet the definition of any of these EECs.



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5.2 Flora

Searches of the EPBC Act Protected Matters database and Atlas of NSW Wildlife identified the potential occurrence of three threatened flora species within 10 km of the study area. Of these, two are listed under both the EPBC Act and TSC Act. One species is listed under the TSC Act only.

A total of 146 flora species were detected in the study area during the field survey from 27-29 April 2015. This comprised 82 native species and 64 introduced species (Appendix D). No threatened flora species were detected in the Study area during the field survey, despite dedicated searches during suitable seasonal conditions. It is considered unlikely that the threatened flora species identified in Table 7 would occur in the study area.

Table 4 Threatened flora, or their habitat, identified from the search area (within 10 km of the Study area)

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence within Study area	Data Source	
		EPBC Act ¹	TSC Act ²			DotE 2015	OEH 2015a
<i>Thesium australe</i>	Austral toadflax	V	V	Shrubland, grassland or woodland, often on damp sites (DotE 2015a); often in association with kangaroo grass (<i>Themeda triandra</i>) (OEH 2013a).	Unlikely. 'May' occur within the broader search area, but not recorded. The study area is largely void of native grasses. Targeted searches amongst native grasses failed to detect this species.	✓	
<i>Tylophora linearis</i>	-	E	V	Dry scrub and open forest on low-altitude sedimentary flats (DotE 2015b).	Unlikely. 'May' occur within the broader search area, but not recorded. Targeted searches failed to detect this species.	✓	
<i>Swainsona sericea</i>	silky swainson-pea	-	V	Natural temperate grassland and snow gum woodland on the Monaro plains; box-gum woodland in the Southern Tablelands and South West Slopes; sometimes in association with Cyprus pine (OEH 2013b).	Unlikely. Identifiable by foliage in autumn (OEH 2013); targeted searches failed to detect this species.		✓

5.3 Fauna

Searches of the EPBC Act Protected Matters database and the Atlas of NSW Wildlife database identified the potential occurrence of 21 threatened fauna species within a search area extending 10 km from the study area (Table 5). Of these species, 10 are listed under both the EPBC Act and TSC Act. The remaining 11 are listed under the TSC Act only. Ten of the fauna species identified from the search are listed as migratory under the EPBC Act.

A total of 57 fauna species were detected in the study area during the field survey from 27-29 April 2015. This comprised four frog species, three reptile species, eight mammal species and 44 bird species (Appendix E). No threatened or migratory fauna species were detected in the Study area during the field survey, despite dedicated searches. However, a number of threatened species are expected to utilise the Lachlan River as a movement corridor.

The Lachlan River riparian corridor represents a continuous, linear patch of habitat. A number of the threatened species identified in Table 5 would be expected to utilise this riparian corridor on occasion. The broader riparian corridor provides suitable foraging, breeding and nesting habitat for a diversity of birds, mammals, amphibians and reptiles. Hollow-bearing trees, such as mature river red gum (*Eucalyptus camaldulensis*) provide potential habitat for threatened birds and mammals along this broader corridor. However, riparian habitat in the immediate vicinity of the proposed CHVB crossing is less mature than most adjoining specimens in the broader corridor, exhibiting only scattered small hollows in river red gums on the western bank and neither small nor large hollows in those specimens on the eastern bank (Appendix B).

Other parts of the Study area provide fauna with opportunities for foraging and nesting and are represented by:

- agricultural pasturelands and associated grasslands
- small patches and narrow corridors of yellow box (*E. melliodora*) woodland
- an avenue of mixed native tree and shrub species planted along Boundary Road
- an avenue of mugga ironbark (*E. sideroxylon*) along Airport Road.

However, these areas are most likely to support common native species, predominately birds, which are more adapted to urban and peri-urban habitats.

Table 5 Threatened and migratory fauna species, or their habitat, identified from the search area (within 10 km of the Study area)

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
Amphibians							
Booroolong frog	<i>Litoria booroolongensis</i>	E	E	On or under boulders and debris in and beside the rocky beds of mountain streams (Cogger 2014).	Unlikely. 'May' occur within the broader search area, but hasn't previously been recorded. No rocky beds, nor mountain streams, detected within the study area.	✓	
Birds							
<i>Anthochaera phrygia</i>	Regent honeyeater	E	E	Ironbark forest; also forests and woodlands of box, yellow gum, swamp mahogany and river oak (Morcombe 2003).	Potential. Western bank of the Lachlan River at the proposed CHVB crossing is co-dominated by river oak on the western bank; river oak abundant on the eastern bank (Appendix A). Nearby records from Wattamondara (15 km), Koorawatha (20 km), Bumbaldry (25 km) and Wyangla Dam (25 km) (OEH 2015a).	✓	
<i>Apus pacificus</i>	Fork-tailed swift	Mi		Low to very high airspace over varied habitat, rainforest to semi-desert, most active just ahead of summer storm fronts (Morcombe 2003).	Unlikely. Species or species habitat 'likely' to occur within the broader search area, but hasn't previously been recorded. Unlikely to utilise resources of the study area.	✓	

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
<i>Ardea modesta</i>	Great egret	Mi		Wetlands, flooded pastures, dams, estuarine mudflats, mangroves and reefs (Morcombe 2003). Nests in colonies located in wooded and shrubby swamps including mangrove forests, Melaleuca swamps and mixed eucalypt / acacia / lignum swamps (DotE 2015c).	Unlikely. Although known to occur in the search area, preferred habitat is unlikely to occur within the study area and was not encountered during field surveys 27-29 April 2015.	✓	
<i>Ardea ibis</i>	Cattle egret	Mi		Moist pastures with tall grass; shallow open wetlands and margins, mudflats (Morcombe 2003). Avoids short grass (DotE 2015d).	Unlikely. Although known to occur in the search area, preferred habitat is unlikely to occur within the study area and was not encountered during field surveys 27-29 April 2015.	✓	✓
<i>Botaurus poiciloptilus</i>	Australasian bittern	E	E	Freshwater wetlands, occasionally estuarine (Morcombe 2003). Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.) (OEH 2014g).	Unlikely. The study area does not support tall, dense aquatic vegetation preferred by this species.	✓	✓
<i>Circus assimilis</i>	Spotted harrier		V	Open grasslands, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation that allows the low 'harrying' mode of hunting (Morcombe 2003).	Potential.		✓

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
<i>Climacteris picumnus victoriae</i>	Brown treecreeper – eastern subspecies		V	Eucalypt forests and woodlands, scrubs of the drier areas, river-edge trees, timbered paddocks (Morcombe 2003).	Potential.		✓
<i>Falco subniger</i>	Black falcon		V	Tree-lined watercourses and isolated stands of trees; hunts out over the low vegetation of surrounding plains, grasslands, saltbush and bluebush (Morcombe 2003).	Potential.		✓
<i>Gallinago hardwickii</i>	Latham's snipe	Mi		Low vegetation around wetlands in shallows, sedges, reeds, heath, salt marsh, irrigated crops (Morcombe 2003).	Unlikely. Species or species habitat 'may' occur within the broader search area, but hasn't previously been recorded. Preferred habitat not evident within the study area.	✓	
<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	Mi		Usually coastal, over islands, reefs, headlands, beaches and bays, estuaries, mangroves, seasonally flooded inland swamps, lagoons and floodplains; often far inland on large pools of major rivers (Morcombe 2003).	Unlikely. Species or species habitat 'likely' to occur within the broader search area, but hasn't previously been recorded. Preferred habitat not evident within the study area.	✓	
<i>Hieraaetus morphnoides</i>	Little eagle		V	Hilly country generating where it often soars on the updrafts generated by wind deflected up the slopes. Forests, woodlands, open scrublands, tree-lined watercourses of the interior (Morcombe 2003).	Potential.		✓

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
<i>Hirundapus caudacutus</i>	White-throated needletail	Mi		High open spaces of sky above almost any habitat, including oceans (Morcombe 2003).	Unlikely. Species or species habitat 'may' occur within the broader search area, but hasn't previously been recorded. High open spaces are considered to be outside the study area.	✓	
<i>Ixobrychus flavicollis</i>	Black bittern		V	Diverse wetlands, estuarine and littoral. Requires dense water-edge vegetation (Morcombe 2003).	Unlikely. Although the Lachlan River in the broader search area provides suitable habitat features, no suitable habitat was evident in the study area at the time of survey.		✓
<i>Lathamus discolor</i>	Swift parrot	E	E	Forests and woodlands with flowering trees (Morcombe 2003).	Potential.	✓	✓
<i>Leipoa ocellata</i>	Malleefowl	V	E	Unburned mallee and woodland with abundant litter and low scrub.	Unlikely. Species or species habitat 'likely' to occur within the broader search area, but hasn't previously been recorded. Preferred habitat not evident within the study area.	✓	
<i>Lophoictinia isura</i>	Square-tailed kite		V	Eucalypt woodland, open forest and heath-woodland (Morcombe 2003).	Potential.		✓
<i>Melithreptus gularis gularis</i>	Black-chinned honeyeater – eastern subspecies		V	Forests, woodland of eucalypts, paperbarks; tree-lined watercourses of arid regions (Morcombe 2003).	Potential.		✓

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
<i>Merops ornatus</i>	Rainbow bee-eater	Mi		Open country of woodlands, open forest, semi-arid scrub, grasslands, clearings in heavier forests, farmlands (Morcombe 2003).	Potential.	✓	
<i>Myiagra cyanoleuca</i>	Satin flycatcher	Mi		Forests and woodlands, mangroves, coastal heath scrubs; in breeding season favours dense, wet gullies of heavy eucalypt forests (Morcombe 2003).	Potential.	✓	
<i>Ninox connivens</i>	Barking owl		V	Open country with stands of trees, tree-lined watercourses and paperbark swamps (Morcombe 2003).	Potential.		✓
<i>Polytelis swainsonii</i>	Superb parrot	V	V	River red gum, box and similar forests, river-edge forest, nearby mallee, native cypress, farmlands (Morcombe 2003).	Potential.	✓	✓
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned babbler – eastern subspecies		V	Open forests, woodlands, road verges with grassy groundcover, sparse shrubbery (Morcombe 2003).	Potential.		✓
<i>Rhipidura rufifrons</i>	Rufous fantail	Mi		Wet sclerophyll forests, often in gullies with a dense shrubby understorey, including ferns. Sometimes recorded in drier sclerophyll forests and woodlands with a shrubby or heath understorey (DotE 2015e).	Unlikely. Species or species habitat 'may' occur within the broader search area, but hasn't previously been recorded. Preferred habitat not evident within the study area.	✓	

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
<i>Rostratula australis</i>	Australian painted snipe	E, Mi	E	Shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (DotE 2015f).	Unlikely. Species or species habitat 'may' occur within the broader search area, but hasn't previously been recorded. Preferred habitat not evident within the study area.	✓	
<i>Stictonella naevosa</i>	Freckled duck		V	Densely vegetated freshwater lakes, swamps, creeks and floodwaters with thickets of melaleuca, casuarina, leptospermum (Morcombe 2003).	Unlikely. No preferred habitat was evident in the study area at the time of survey, nor is it likely to occur at other times of the year.		✓
Mammals							
<i>Nyctophilus corbeni</i>	Corben's long-eared bat	V	V	Vegetation with distinct canopy and a dense, cluttered understorey layer; a wide variety of vegetation types including river red gum, black box, <i>Allocasuarina</i> , belah, mallee, open woodlands and savannahs (Churchill 2008). Most common in box, ironbark and cypress-pine vegetation along the western slopes and plains of NSW and southern Queensland (OEH 2012a).	Unlikely. 'Likely' to occur within the broader search area, but hasn't previously been recorded. Vegetation structure of study area aligns poorly with that of the preferred habitat (i.e. distinct canopy and dense, cluttered understorey).	✓	
<i>Petaurus norfolcensis</i>	Squirrel glider		V	Dry sclerophyll forest and woodland in south-eastern Australia (Strahan 1995). Large trees with abundant hollows, with a preference for large cavities that can house multiple gliders in a large nest, yet with a small entrance that protects the group from predators like goannas (NSW	Unlikely. Riparian habitat at the proposed CHVB river crossing exhibits only scattered small hollows in river red gums on the western bank and neither small nor large hollows in specimens on the eastern bank (Appendix B). Other parts of the study area lack preferred, in-tact habitat.		✓

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Source	
		EPBC Act	TSC Act			DotE 2015	OEH 2015a
				Scientific Committee 2008).			
<i>Phascolarctos cinereus</i>	Koala	V	V	In this instance west of the Great Dividing Range, the koala follows river red gum (<i>Eucalyptus camaldulensis</i>) forests that skirt the mosaic of rivers and watercourses (Strahan 1995). Also found within <i>Melaleuca</i> , <i>Casuarina</i> and woodland of other <i>Eucalyptus</i> species.	Unlikely. 'May' occur within the broader search area, but hasn't previously been recorded. Unlikely to reside within such exposed habitat affected by human visitation and traffic noise.	✓	
Reptiles							
<i>Aprasia parapulchella</i>	Pink-tailed worm-lizard	V	V	Found under weathered granite rocks and logs in (mostly) native grasslands (Cogger 2014).	Unlikely. 'May' occur within the broader search area, but not previously recorded. Native grassland observed within study area devoid of weathered granite rocks and logs.	✓	

Notes: 1. Environment Protection and Biodiversity Conservation Act 1999. 2. Threatened Species Conservation Act 1995.

5.4 Aquatic habitat and species composition

5.4.1 Waterway classification

The Lachlan River is a CLASS 1 Major key fish habitat as per the Policy and guidelines for fish habitat conservation and management (DPI 2013), due to being a *permanently flowing or flooded freshwater waterway (e.g. river or major creek) and habitat of a threatened or protected fish species*. The policy provides management recommendations for CLASS 1 waterways, which have been incorporated into Section 7.

5.4.2 Aquatic Ecological Communities

The aquatic ecological community of the lower Lachlan River Catchment is listed as an EEC under the FM Act (Lachlan River EEC). The Lachlan River EEC includes all natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands, paleochannels, flood-runners, floodplains and effluent streams of the Lachlan River. The study area, at the proposed Lachlan River crossing, forms part of this EEC.

5.4.3 Aquatic habitat

At the time of survey, the Lachlan River study reach was in a state of low flow (<watermark) and provided a mix of velocity/depth categories allowing for occupation and movement of both strong and weak swimming fishes. This included areas of slow deep (<0.3 m/s and >0.5 m), slow shallow (<0.3 m/s and <0.5 m), fast deep (>0.3 m/s and >0.5 m) and fast shallow (>0.3 m/s and <0.5m) habitats.

Bed substrates of the study reach were dominated by gravel (80%) and sand (20%). Edge habitats provided marginally better substrate complexity with gravel (35%), sand (50%), silt (10%) and clay (5%). The stream bed was highly mobile, and as a result was devoid of macrophytes, detritus (leaves, twigs) and woody debris (sticks, branches, logs). Edge habitat attributes were more complex and included periphyton (little [1-10%]), filamentous algae (little), macrophytes (little), bank overhang vegetation (little), trailing bank vegetation (little) and blanketing silt (some).

Macrophytes occurred occasionally in the edge habitat, represented by common native species: gaint sedge (*Cyperus exaltatus*), river clubrush (*Schoenoplectus validus*) and common rush (*Juncus usitatus*).

Physico-chemical water quality

The following in situ measurements were obtained at 11:30 on 28 April 2015:

- water temperature was 12.7 °C
- pH levels were 8.1 (moderately alkaline), falling within the WQO guideline range of 6.5–8.5 (EPA 2006)
- alkalinity was 90 mg/L (moderately hard)
- electrical conductivity was 362 µS/cm (fresh), falling well within the WQO guideline range of 125–2200 µS/cm for aquatic ecosystems (EPA 2006)
- dissolved oxygen (DO) levels were at 80% saturated (8.45 mg/L), falling slightly below the WQO guideline range of 85–110% (EPA 2006); however, DO concentrations vary

diurnally (and with depth) and would be expected to climb to within the guideline range as the day progressed

- turbidity was low (4 NTU), falling slightly below the WQO guideline range of 6–50 NTU. It is noted that low turbidity is only problematic when there is high nutrient load in the catchment.

5.4.4 Macroinvertebrates

Taxonomic richness

A total of 20 macroinvertebrate taxa were collected from the edge habitat in the Lachlan River study reach on 28 April 2015b. This result is comparable to the number of taxa (mean 19, range 10-29) identified from 11 sites sampled in the 'slopes' zone of the Lachlan Valley in the second Sustainable Rivers Audit (MDBA 2012).

PET richness

Six PET taxa were detected in the edge habitat, consisting of one Plecoptera (stonefly): Gripopterygidae; three Ephemeroptera (mayflies): Baetidae, Caenidae and Leptophlebiidae; and two Trichoptera (caddis flies): Hydrobiosidae and Leptoceridae. The presence of pollution-sensitive taxa from all three PET orders suggests that the stream reach is largely free from degradation or pollution.

SIGNAL2 and tolerant taxa

The average SIGNAL2 score of 4.45 for the edge habitat is favourably higher than 4 (pollution tolerant taxa have a SIGNAL2 sensitivity score of 4 or less). The percentage composition of tolerant macroinvertebrate taxa in the edge habitat was 75%. The average SIGNAL2 score was favourably elevated by the presence of highly sensitive taxa from the families Hydrobiosidae, Leptophlebiidae and Gripopterygidae, each with a SIGNAL2 score of 8. The results reflect the diversity of microhabitats found within the edge habitat of the study reach (Section 5.4.1).

AusRivAS OE50

The AusRivAS model placed the collected macroinvertebrate sample into Band A, suggesting that the edge habitat composition is favourably at reference condition, containing most or all of the expected macroinvertebrate families.

5.4.5 Macro-crustaceans

Aquatic surveys detected three macro-crustacean families: Atyidae (freshwater shrimp), Palaemonidae (freshwater prawns) and Parastacidae (freshwater crayfish). Atyidae were identified as *Paratya australiensis*, Palaemonidae were identified as *Macrobrachium* sp. and Parastacidae were identified as common yabby (*Cherax destructor*). Each of these species were predicted to occur within the study reach.

5.4.6 Fishes

Searches of the NSW DPI Records Viewer (DPI 2015), EPBC Act Protected Matters database (DoE 2015), Atlas of NSW Wildlife database (OEH 2015a) and the Sustainable Rivers Audit 2 (MDBA 2012) identified eight threatened fishes and one threatened invertebrate (the river snail)

as having been recorded from the broader Lachlan River catchment (Table 6). Of these species, three fishes are listed under both the EPBC Act and FM Act. The remaining five fishes and the river snail are listed under the FM Act only.

A distinct lack of fish activity was noted in the Lachlan River study reach at the time of survey, despite the high clarity, shallow waters and expected high detectability of fish. Only ten fishes were detected, nine of which were captured using backpack electrofishing techniques. This included the river blackfish – a nocturnal species that is becoming rare in the Lachlan River catchment; this species was not recorded from the Lachlan River catchment in the latest Sustainable Rivers Audit (MDBA 2012).

Four species of fish were detected within the study reach, comprising three native (Plates 1 to 3) and one introduced* species:

- Northern river blackfish (*Gadopsis marmoratus*)
- Mountain galaxias (*Galaxias olidus*)
- Carp gudgeon (*Hypseleotris* sp.)
- Common carp (*Cyprinus carpio*)*

Each of these species has previously been recorded from the Lachlan catchment.

Table 6 Threatened fish and invertebrate species recorded from the Lachlan River catchment

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Data Source			
		EPBC Act	FM Act			DotE 2015	OEH 2015a	DPI 2015	MDBA 2012
<i>Maccullochella peelii</i>	Murray cod	V	-	Slow flowing, turbid water of rivers and streams at low elevations; also fast-moving, clear rocky upland streams (Allen et al. 2002). Preferring habitats with instream cover such as rocks, stumps, fallen trees or undercut banks (Lintermans 2007).	Potential.	✓		✓	✓
<i>Maccullochella peelii</i>	Trout cod	E	E	Large amount of woody debris in deep water, often close to the riverbanks (SEWPaC 2011).	Unlikely.			✓	
<i>Macquaria australasica</i>	Macquarie perch	E	E	Cool, clear water of rivers, lakes and reservoirs. Prefers slow-flowing, deep rocky pools (Allen et al. 2002).	Unlikely.	✓	✓	✓	
<i>Mogurnda adspersa</i>	Purple-spotted gudgeon	-	E	Slow-moving or still waters of rivers, creeks and billabongs, often amongst weeds, rocks or large woody debris (NSW DPI 2005).	Unlikely.			✓	
<i>Nannoperca australis</i>	Southern pygmy perch	-	E	Vegetated areas in small streams, lakes, billabongs and other types of wetlands; recently discovered in the upper Lachlan catchment (NSW DPI 2005).	Unlikely.			✓	
<i>Ambassis agassizii</i>	Olive perchlet (western population)	-	E	Slow-flowing or still waters of rivers, creeks, ponds and swamps, often near overhanging vegetation or amongst logs, dead branches and boulders (NSW DPI 2005).	Unlikely.			✓	
<i>Tandanus tandanus</i>	Freshwater catfish (Murray-Darling Basin population)	-	E	Sluggish or still waters of rivers, creeks, lakes, billabongs and lagoons (FSC 2008).	Unlikely.			✓	

Scientific name	Common name	Status		Preferred habitat	Likelihood of occurrence in the Study area	Data Source			
		EPBC Act	FM Act			DotE 2015	OEH 2015a	DPI 2015	MDBA 2012
<i>Bidyanus bidyanus</i>	Silver perch	CE	V	Faster-flowing water, including rapids and races, and more open sections of river, throughout the Murray-Darling Basin (Clunie and Koehn 2001, cited in TSSC 2013).	Potential.	✓	✓	✓	
<i>Notopala sublineata</i>	River snail		E	Flowing rivers throughout the Murray-Darling system, along the banks attached to logs and rocks or on muddy substrates (NSW DPI 2005). Now surviving in irrigation pipelines.	Unlikely.				

Note: 1. Environment Protection and Biodiversity Conservation Act 1999; 2. NSW Fisheries Management Act 1994.



Plate 1 Northern river blackfish (*Gadopsis marmoratus*), Lachlan River, 28 April 2015



Plate 2 Mountain galaxias (*Galaxias olidus*), Lachlan River, 28 April 2015



Plate 3 Carp gudgeon (*Hypseleotris* sp.), Lachlan River, 28 April 2015

5.4.7 Turtles

A search of the Atlas of NSW Wildlife database (OEH 2015a) identified only one species of turtle from the search area. This is the eastern snake-necked turtle (*Chelodina longicollis*), a species commonly found throughout eastern Australia. No turtles were encountered during the field survey, although may occur within the study reach on occasion.

5.4.8 Platypus

The platypus (*Ornithorhynchus anatinus*), protected under the NPW Act, has previously been recorded approximately 10 km upstream of the study reach. No platypus were detected during the field survey. The study reach lacks suitable breeding habitat for the platypus, with bank substrates dominated by apedal sands and unlikely to be suitable for burrow construction. However, it is likely that platypus would transit the study reach on occasion.

5.5 Critical habitat

Critical habitat is defined by the FM Act as the whole or any part of the habitat of an endangered species, population or ecological community that is critical to the survival of the species, population or ecological community. Critical habitat must be identified and declared by the Minister for Primary Industries. As of 13 May 2015, only the grey nurse shark critical habitat is identified on the Register of Critical Habitat (DPI 2015). No critical habitat occurs within the study area.

6 POTENTIAL IMPACTS

6.1 Flora

6.1.1 Vegetation removal

Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. This vegetation is dominated by agricultural pasturelands and associated grasslands. Other vegetation types intersected by the CHVB include Floodplain Complex on the banks of the Lachlan River, isolated occurrences of degraded Yellow Box Woodland, and an avenue of predominately planted trees along Boundary Road and Airport Road.

Following construction of the CHVB, much of the lost vegetation would be allowed to regenerate and new landscape plantings would be undertaken as part of the works.

The road pavement and batters indicated in Revision A of the Cowra Traffic Relief Route (GHD 2012), ground-truthed in the field, indicates that the proposed works would require the removal of approximately:

- 30 isolated trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River
- 0.2 ha of riparian vegetation mapped as Floodplain Complex
- 50 mature tree plantings on Airport Road
- 50 mature tree plantings on Boundary Road.

The clearing of Floodplain Complex vegetation along the Lachlan River is considered minor in terms of vegetation loss, considering the degraded condition of vegetation within the proposed clearing footprint (dominated by exotic Willows) and the extent of vegetation remaining in adjoining, less degraded habitats.

6.1.2 Threatened species and ecological communities

No threatened flora species (listed under either the EPBC Act or TSC Act) were detected within the study area, despite dedicated searches during suitable seasonal conditions. It is unlikely that threatened flora species occur within the proposed impact areas.

No TECs listed under the EPBC Act, nor EECs listed under the TSC Act, were detected within the study area. It is unlikely that TECs or EECs occur within the proposed impact areas. As such, no TECs, EECs (excluding those listed under the FM Act) or threatened flora species are expected to be impacted by the works.

6.1.3 Weeds

Noxious weed species occurring within the study area that would be removed or otherwise managed as part of the works include black willow (*Salix nigra*), crack willow (*Salix fragilis*), blackberry (*Rubus fruticosus*), St John's wort (*Hypericum perforatum*), Silver-leaved nightshade (*Solanum elaeagnifolium*) and Blue heliotrope (*Solanum elaeagnifolium*) (Appendix D).

If left unmitigated, construction activities have the potential to introduce and promote the spread of weeds through the use of unclean machinery which can spread weed propagules.

6.2 Fauna

6.2.1 Habitat loss

Vegetation removal is discussed in Section 6.1.1. A small number of trees bearing small hollows were recorded within the study area and would require removal as part of the CHVB works. This includes a river red gum (*Eucalyptus camaldulensis*) on the western bank of the Lachlan River, two river red gums and three grey box (*E. microcarpa*) between the Lachlan River and the Mid Western Highway. Considering the limited vegetation removal required and the extent of similar vegetation in the broader area, particularly along the riparian corridor of the Lachlan River, impacts are considered to be minor.

6.2.2 Connectivity and habitat fragmentation

The riparian corridor of the Lachlan River provides habitat for a diversity of fauna, and is likely to provide habitat for a number of threatened species, particularly birds (Section 5.3). The proposed works may temporarily fragment habitat available for wildlife along the banks of the Lachlan River through the removal of approximately 0.2 ha of Floodplain Complex vegetation. However, most of this area would be rehabilitated post-construction, including the bank beneath the bridge abutments. This would include replacing weedy species (such as willows and blackberry) with a mix of native tree and shrub species to help restore habitat connectivity.

6.2.3 Threatened and migratory species

Impacts to the following threatened fauna species may occur as a result of the proposal (Table 5):

- Regent honeyeater (*Anthochaera phrygia*) – Endangered (EPBC Act and TSC Act)
- Spotted harrier (*Circus assimilis*) – Vulnerable (TSC Act)
- Brown treecreeper – eastern subspecies (*Climacteris picumnus victoriae*) – Vulnerable (TSC Act)
- Black falcon (*Falco subniger*) – Vulnerable (TSC Act)
- Little eagle (*Hieraaetus morphnoides*) – Vulnerable (TSC Act)
- Swift parrot (*Lathamus discolor*) – Endangered (EPBC Act and TSC Act)
- Square-tailed kite (*Lophoictinia isura*) – Vulnerable (TSC Act)
- Black-chinned honeyeater – eastern subspecies (*Melithreptus gularis gularis*) – Vulnerable (TSC Act)
- Barking owl (*Ninox connivens*) – Vulnerable (TSC Act)
- Superb parrot (*Polytelis swainsonii*) – Vulnerable (EPBC Act and TSC Act)
- Grey-crowned babbler – eastern subspecies (*Pomatostomus temporalis temporalis*) – Vulnerable (TSC Act)

Seven-part tests of significance have been undertaken for these species and are provided as Appendix F. The assessments determined that the proposal is unlikely to result in a significant impact on any of these fauna species.

There is potential for the following migratory bird species to utilise the study area on occasion:

- Rainbow bee-eater (*Merops ornatus*) – Migratory (EPBC Act)
- Satin flycatcher (*Myiagra cyanoleuca*) – Migratory (EPBC Act)

Seven-part tests of significance have been undertaken for these MNES species, consistent with the bilateral agreement between the Australian and NSW Governments (DPI 2013) and are provided in Appendix F. The assessments determined that the proposal is unlikely to result in a significant impact on any of these migratory species.

6.3 Aquatic ecology

Works within and along the banks of the Lachlan River have the potential to impact aquatic ecological values through:

- vegetation clearing, earthworks, and vehicle use within, or adjacent to, waterways
- creation of barriers obstructing surface water flows and aquatic fauna passage
- unmitigated sediment laden stormwater runoff entering waterways
- spills of contaminants such as fuels, oils or chemicals that could migrate into waters.

An area of approximately 0.06 ha of riverbed would be impacted by instream works. Additionally, riparian habitat of approximately 0.2 ha would be impacted. Loss of riparian vegetation would reduce edge habitat complexity, shelter and organic inputs into the stream reach. Weed management and site rehabilitation would assist in reducing impacts.

The installation of instream structures such as piers has the potential to affect local hydrology which may result in bank erosion, particularly during floods. Scour protection may need to be installed to minimise the risk of bank erosion, especially as willows are removed / managed from the river bank.

A coffer dam will likely be required for construction of individual bridge piers. Partial obstruction of flow by the coffer dams is unlikely to impede free fish passage. The cofferdams would require dewatering during installation. This has the potential to increase turbidity temporarily. The coffer dams also have the potential to capture fish, and these would need to be salvaged during the dewatering.

The installation of instream structures (piers) may directly impact aquatic habitat through dredging and / or reclamation. This may include the removal of large woody debris located within the footprint of piers and coffer dams. Works that involve dredging or reclamation require consultation with DPI (Fisheries). The direct impact of any dredging or reclamation on instream habitat is expected to be minimal, owing to the relatively small impact footprint and the prevalence of similar habitat extending both upstream and downstream of the proposed crossing location. Impacts would be localised and a small amount of large woody debris may need to be relocated from areas of disturbance.

Construction of the project has the potential to impact surface water quality through increased erosion of sediments left exposed following vegetation clearing. In the absence of suitable controls, mobilised sediments can lead to increased suspended sediment loads in waterways. This can in turn reduce light penetration and visibility, limiting plant growth and impede fish movement. Increased sedimentation can also affect water chemistry, reduce waterway depths, change drainage patterns and smother benthic flora and fauna.

Leaks or spills of hydrocarbon based fluids from construction equipment presents a potential risk. Hydrocarbons are toxic to aquatic flora and fauna at relatively low concentrations. Runoff of spilled fuels and oils into waterways is only likely to occur if spills occur in close proximity to the waterway, or if the spill or leak is left uncontrolled. The severity and duration of impacts would depend on the type and quantity of any fuel or oil spilled, and the effectiveness of containment measures.

The existing box culvert crossing of Waugoola Creek would be augmented as part of the works. New box culverts would be installed as part of the widening of this crossing. These would be installed so as to maintain fish passage in accordance with the DPI (2013) policy and guideline.

6.3.1 Threatened aquatic species and endangered ecological community

Impacts to the following two threatened fish species and EEC may occur as a result of the proposal (Table 6):

- Silver perch (*Bidyanus bidyanus*) – Vulnerable (FM Act), Critically Endangered (EPBC Act)
- Murray Cod (*Maccullochella peelii*) – Vulnerable (FM Act)
- The aquatic ecological community in the natural drainage system of the lowland catchment of the Lachlan River (Lachlan River EEC) – EEC (FM Act)

Seven-part tests of significance have been undertaken for these species and EEC and are provided as Appendix F. The assessments determined that the proposal is highly unlikely to result in a significant impact on either of these fish species or the Lachlan River EEC.

7 MITIGATION MEASURES

The following measures would assist in minimising the biodiversity impacts of the CHVB:

- An Erosion and Sediment Control (ESC) Plan would be developed for the CHVB and implemented during construction site establishment to minimise the likelihood of construction related activities mobilising sediments and leading to turbidity and sedimentation of waterways.
- Clearly defined access and work use areas for plant and equipment should be established, and all members of the construction crew made aware of these access and work area limits. Movement of plant and equipment should be restricted to these areas to minimise the potential for uncontrolled spills or leaks entering waterways.
- Under Section 199 of the FM Act, DPI (Fisheries) would be notified of any proposed reclamation or dredging as defined under the FM Act associated with installation of instream structures (temporary and permanent) and other structures.
- Construction methods must allow for the free passage of fish downstream and upstream of the works areas at all times.
- Any dewatering of a coffer dam must consider:
 - Notifying DPI seven days prior to dewatering to organise potential fish salvage. A separate section 37 permit may be required for this purpose.
 - Affected water should be pumped a minimum 30 m away from the river and should not re-enter the river. If water is to re-enter the river, water quality parameters must not be significantly different to receiving waters (as measured upstream of disturbance areas).
- Only the minimum number of snags should be disturbed within wetted habitat.
- Pre-clearance terrestrial fauna surveys/checks must be undertaken by an ecologist approximately 1-5 days prior to vegetation clearing to identify and mitigate against direct impacts on breeding places of threatened bird species (including parrots, woodland birds and raptors). Any trees observed to contain an active breeding place of a threatened species must be cordoned off and left untouched until young have fully fledged and vacated the immediate area.
- If the pre-clearance terrestrial fauna survey/check identifies an occupied nest of a threatened species, nest boxes would be placed into nearby retention areas as an attempt to offset impacted tree hollows for use during subsequent breeding events.
- Utilise areas already impacted by previous clearing or disturbance and minimise clearing where feasible. Trimming of native trees would be preferred over removal where feasible.
- Trees should be removed in such a way as to not inadvertently damage surrounding vegetation. This would keep groundcover disturbance to a minimum.
- Where possible, native trees to be removed should be mulched and re-used in surrounding areas.
- Felling of hollow-bearing trees should be avoided where possible.
- An ecologist, experienced in fauna handling, should be present during tree-felling to ensure that potential impacts on fauna are minimised and to treat (or transport) any animals inadvertently injured.
- Revegetation of bare soil or cleared areas should be undertaken with locally-occurring native flora species typical of the original habitat to improve floristic structure and provide habitat for those native and threatened species with potential to occur in the study area.

- Declared noxious weeds should be managed according to the requirements stipulated by the *Noxious Weeds Act 1993*.
- Vehicles and machinery should be kept away from the banks of waterways where possible.
- Areas for vehicle and machinery maintenance, refuelling, and storage of fuels, lubricants, and batteries, should be bunded in accordance with Australian Standard AS 1940-2004 *The storage and handling of flammable and combustible liquids*. Refuelling during construction should be undertaken only within a designated bunded area.
- Maintenance and daily checks of plant and equipment must be undertaken to minimise the risk of hydrocarbon spills or leaks.
- Emergency spill kits must be made available and readily accessible for all plant and equipment at all times, and should include equipment for containment and clean-up of spills on dry soils/sediments as well as for water (e.g. floating booms).
- Any contaminant spills (including fuel, hydraulic fluid etc.) must be contained (where safe to do so) and immediately reported to the construction manager / environmental advisor to establish a plan for remediation.
- watercourse crossings should be designed to maintain or enhance water flows, water quality, stream ecology and riparian vegetation. Impacts to the hydrologic, hydraulic and geomorphic functions of the stream should be minimised.
- watercourse crossings should be designed in accordance with the NSW Office of Water (2012) Guidelines for Watercourse Crossings, which include:
 - minimising the construction footprint and the extent of proposed disturbance within the watercourse and riparian corridor
 - where practicable, avoiding structured native riparian vegetation
 - fully span the watercourse channel where possible (Figure 7)

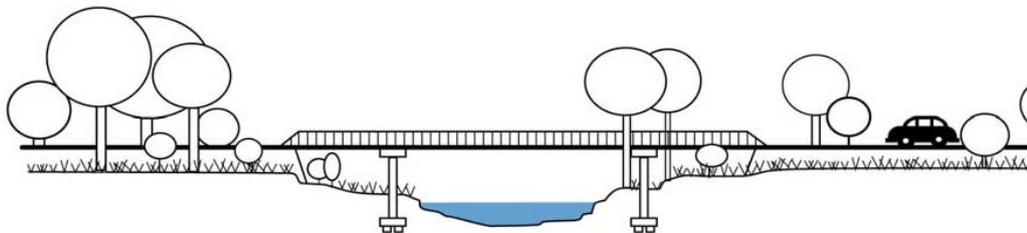


Figure 7 Bridge crossing over a watercourse (NSW Office of Water 2012)

- maintaining existing or natural hydrologic, hydraulic, geomorphic and ecological functions of the watercourse
- maintaining natural geomorphic processes by:
 - accommodating natural watercourse functions
 - avoiding alterations to natural bankfull or floodplain flows, or increased water levels upstream
 - avoiding changes to the gradient of the stream bed, except where necessary to address existing bed and bank degradation
 - avoiding increases in flow velocities by, for example, constricting flows
- protecting against scour by:
 - providing any necessary scour protection, such as rip-rap and vegetation
 - ensuring scour protection of the bed and banks downstream of the structure is extended for a distance of either twice the channel width, or 20 m whichever is the lesser

- stabilising and rehabilitating all disturbed areas including topsoiling, revegetating, mulching, conducting weed control and maintenance, to restore the integrity of the riparian corridor
- where culverts are installed on Waugoola Creek:
 - box culverts are preferred to pipes
 - culverts would be aligned with downstream channels
 - recessed wet cells should be incorporated within the invert at or below the stable bed level (Figure 8)
- the culvert design should be certified by a suitably qualified engineer
- the design should ensure wet cells allow a minimum water depth of 0.2-0.5 m to encourage fish passage
- the design should minimise changes to the channels natural flow, width, roughness and base-flow water depth.

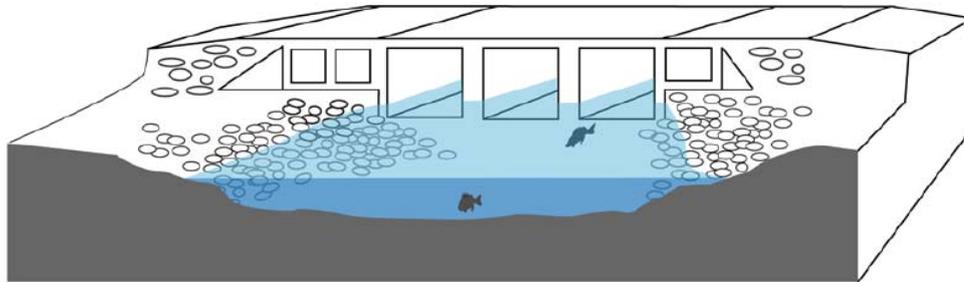


Figure 8 Conceptual road crossing facilitating fish passage (NSW Office of Water 2012)

8 CONCLUSION AND RECOMMENDATIONS

The study area is dominated by agricultural pasturelands and associated grasslands. Small patches and narrow corridors of Yellow Box Woodland represent remnants of original box-gum woodland of the area. The Lachlan River riparian corridor is vegetated by a Floodplain Complex which has also been significantly cleared and confined by prior land-uses.

The road pavement and batters indicated in Revision A of the Cowra Traffic Relief Route (GHD 2012), ground-truthed in the field, indicates that the proposed works would require the removal of approximately:

- 30 isolated trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River
- 0.2 ha of riparian vegetation along the Lachlan River mapped as Floodplain Complex
- 50 mature landscape plantings and isolated remnant trees on Airport Road
- 50 mature landscape plantings and isolated remnant trees on Boundary Road.

The clearing of Floodplain Complex vegetation along the Lachlan River is considered minor in terms of vegetation loss, considering the degraded condition of vegetation within the proposed clearing footprint (dominated by exotic willows) and the extent of vegetation remaining in adjoining, less degraded habitats.

The existing crossing of Waugoola Creek would be utilised. Widening of this crossing would require removal of some trees, predominately exotic poplars.

Impacted landscape plantings on Airport and Boundary roads should be avoided where practicable, or otherwise replaced as part of the works, utilising species native to the local area.

It is suggested that Council consider softening the bend (cutting the corner) at Boundary Road and Airport Road to avoid the need to remove mature specimens of grey box (*Eucalyptus microcarpa*) and yellow box (*E. melliodora*) within 50m of the intersection. Presumably this would also improve traffic flow.

No threatened or migratory fauna species were detected during the field survey, despite dedicated searches. However, a number of threatened species are expected to utilise the riparian corridor of the Lachlan River on occasion, primarily as a movement corridor.

Hollow-bearing trees, such as mature river red gum (*Eucalyptus camaldulensis*) provide potential habitat for threatened birds and mammals along the Lachlan River. However, riparian habitat in the immediate vicinity of the proposed CHVB river crossing is less mature than most adjoining specimens in the broader corridor, exhibiting only scattered small hollows in river red gums on the western bank and neither small nor large hollows in specimens on the eastern bank.

Other parts of the study area provide fauna with varying opportunity for foraging, roosting and nesting; however, these areas are most likely to support common native species, predominately birds that are adapted to urban and peri-urban habitats.

The proposed Lachlan River crossing location has been subject to numerous past disturbance, including clearing associated with the rail bridge, construction of a concrete pit / structure and overhead powerlines, as well as grazing, human visitation, rubbish dumping and weed ingress. The proposed crossing location is contained to previously disturbed areas of the riparian corridor. These works provide an opportunity to manage willows (*Salix* spp.) within this area, assisting with stabilisation of the river bank.

The reach of the Lachlan River intersected by the proposed route does not represent unique or high value aquatic habitat. Bed substrates are highly mobile, dominated by gravel and sand. A number of native fish species are likely to either inhabit or transit this stream reach, three of which were encountered during the site visit: northern river blackfish (*Gadopsis marmoratus*),

mountain galaxias (*Galaxias olidus*) and carp gudgeon (*Hypseleotris sp.*). Other native fishes are likely to transit the stream reach on occasion. Consequently, the bridge should be designed to ensure that fish passage is maintained, and that construction impacts on native fishes are minimised.

The proposed CHVB is unlikely to result in a significant impact on threatened or migratory species or ecological communities recognised as MNES by the EPBC Act. Similarly, the proposed CHVB is unlikely to result in a significant impact on threatened species, populations or ecological communities or their habitats, within the meaning of the TSC Act or FM Act. Consequently, the requirement for a Species Impact Statement is not triggered.

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Appendix A: Site Descriptions – Flora Observations

<p>Survey Code FL1</p> <p>Location Europa Park, Cowra</p> <p>Date 29/04/2015</p> <p>Latitude -33.830628</p> <p>Longitude 148.708360</p> <p>Assessed By DM, DL</p>	
General Site Description	
Landform	Gently undulating plain.
Geology	Alluvial.
Mapped Vegetation	Yellow Box Woodland (DECC 2008).
Observed Vegetation	<p>Non-remnant.</p> <p>Canopy dominated by the exotic Lombardy poplar (<i>Populus nigra</i>), with occasional river red gum (<i>Eucalyptus camaldulensis</i>) (16-19 m) and yellow box (<i>Eucalyptus melliodora</i>) regrowth. Mid-storey species included occasional Lombardy poplar and river red gum saplings. Groundcover dominated by common couch (<i>Cynodon dactylon</i>), with abundant <i>Paspalum</i> sp., phalaris (<i>Phalaris aquatic</i>), buffalo grass (<i>Stenotaphrum secundatum</i>), frequent purpletop (<i>Verbena bonariensis</i>) and <i>Digitaria</i> sp.</p>
General Site Observations	Trees form dominant stratum (about 30% cover); semi-isolated, linear patch, <35 m wide; disturbance associated with existing road, mowing of adjacent open space parkland, overhead powerline easement, and weed ingress; both canopy and groundcover dominated by weeds.
Health	Degraded.
TSC Act status	Unlikely to represent an EEC.
EPBC Act status	Unlikely to represent a TEC.

Survey Code FL2	
Location Lachlan River, Eastern bank of proposed crossing location, Cowra	
Date 29/04/2015	
Latitude -33.850934	
Longitude 148.682609	
Assessed By DM, DL	
General Site Description	
Landform	Stream bank.
Geology	Alluvial.
Mapped Vegetation	Floodplain Complex (Central Lachlan) (DECC 2008).
Observed Vegetation	<p>Floodplain Complex (Central Lachlan).</p> <p>Canopy dominated by river red gum (<i>Eucalyptus camaldulensis</i>) (16-21 m), with abundant river oak (<i>Casuarina cunninghamiana</i>), crack willow (<i>Salix fragilis</i>) and frequent black willow (<i>Salix nigra</i>). Mid-storey dominated by juvenile willows (<i>Salix</i> spp.) and blackberry (<i>Rubus anglocandicans</i>). Ground-layer dominated by exotic species including variegated thistle (<i>Silybum marianum</i>), purpletop (<i>Verbena bonariensis</i>), tall wheatgrass (<i>Lophopyrum ponticum</i>), wild oat (<i>Avena fatua</i>), Phalaris (<i>Phalaris aquatica</i>) and occasional natives including common couch (<i>Cynodon dactylon</i>) and dock (<i>Rumex</i> spp.).</p>
General Site Observations	Trees form dominant stratum (about 70% cover); linear patch shape (watercourse); riparian corridor (encompassing both banks) approx. 90m wide; disturbance associated with rail bridge, rubbish dumping, regular human visitation, past clearing for overhead powerlines, occasional grazing, and weed infestation.
Health	Poor.
TSC Act status	Unlikely to represent an EEC.
EPBC Act status	Unlikely to represent a TEC.

Survey Code FL3	
Location Lachlan River, Western bank of proposed crossing location, Cowra	
Date 29/04/2015	
Latitude -33.850616	
Longitude 148.681987	
Assessed By DM, DL	
General Site Description	
Landform	Stream bank.
Geology	Alluvial.
Mapped Vegetation	Floodplain Complex (Central Lachlan) (DECC 2008).
Observed Vegetation	<p>Floodplain Complex (Central Lachlan).</p> <p>Canopy dominated by river red gum (<i>Eucalyptus camaldulensis</i>) and river oak (<i>Casuarina cunninghamiana</i>), with occasional crack willow (<i>Salix fragilis</i>) and black willow (<i>Salix nigra</i>). Mid-storey dominated by weeds including <i>Prunus</i> sp., crab apple (<i>Malus pumila</i>) and blackberry (<i>Rubus anglocandicans</i>). Ground-layer dominated by exotic species including wild oat (<i>Avena fatua</i>), barley grass (<i>Hordeum leporinum</i>), Phalaris (<i>Phalaris aquatica</i>), variegated thistle (<i>Silybum marianum</i>), common thornapple (<i>Datura stramonium</i>), purpletop (<i>Verbena bonariensis</i>), and occasional natives including common couch (<i>Cynodon dactylon</i>), giant sedge (<i>Cyperus exaltatus</i>) and scrub nettle (<i>Urtica incisa</i>).</p>
General Site Observations	Trees form dominant stratum (30-70% cover); linear patch shape (watercourse); riparian corridor (encompassing both banks) approx. 90m wide; disturbance associated with rail bridge, construction of concrete pit/structure, horse grazing, rubbish dumping, regular human visitation, past clearing for overhead powerlines and weed infestation.
Health	Poor.
TSC Act status	Unlikely to represent an EEC.
EPBC Act status	Unlikely to represent a TEC.

<p>Survey Code FL4</p> <p>Location 70 m east of Airport Rd / Boundary Rd intersection, Cowra</p> <p>Date 29/04/2015</p> <p>Latitude -33.847517</p> <p>Longitude 148.654269</p> <p>Assessed By DM, DL</p>	
General Site Description	
Landform	Gently undulating plain.
Geology	Red-yellow loam.
Mapped Vegetation	Non-remnant (DECC 2008).
Observed Vegetation	<p>Non-remnant.</p> <p>Canopy Dominated by grey box (<i>Eucalyptus microcarpa</i>) with occasional yellow box (<i>E. melliodora</i>). Dominated by road-side plantings, interspersed with more mature, but potentially naturally occurring, grey box and yellow box. No recruitment of canopy species detected. Sparse mid-layer represented by the exotic African boxthorn (<i>Lycium ferocissimum</i>). Ground-layer dominated by exotic species including ribwort (<i>Plantago lanceolata</i>), khaki weed (<i>Alternanthera pungens</i>), <i>Paspalum</i> sp., African lovegrass (<i>Eragrostis curvula</i>), perennial ryegrass (<i>Lolium perenne</i>) and common peppergrass (<i>Lepidium africanum</i>), with occasional natives including <i>Poa</i> sp. and curly windmill grass (<i>Enteropogon ramosus</i>).</p>
General Site Observations	Trees form dominant stratum (about 30% cover); semi-isolated patch, <1 ha; linear patch shape (road), <35 m wide; weeds frequent; disturbance associated with slashing and weed ingressión.
Health	Degraded.
TSC Act status	Unlikely to represent an EEC.
EPBC Act status	Unlikely to represent a TEC.

Appendix B: Site Descriptions – Fauna Habitat

Survey Code FA1	
Location Europa Park, Cowra	
Date 29/04/2015	
Latitude -33.830628	
Longitude 148.708360	
Assessed By DM, DL	

General Site Description

Landform	Gently undulating plain.
Soil	Brown clayey loam.
Mapped Vegetation	Yellow Box Woodland (DECC 2008).
Observed Vegetation	Non-remnant. Dominated by the introduced Lombardy poplar (<i>Populus nigra</i>), with occasional river red gum (<i>Eucalyptus camaldulensis</i>) and yellow box (<i>Eucalyptus melliodora</i>).
General Site Observations	Trees form dominant stratum (about 30% cover); semi-isolated, linear patch, <35 m wide; disturbance associated with existing road, mowing of adjacent open space parkland, overhead powerline easement, and weed ingress; groundcover dominated by weeds.

Fauna Habitat Observations

Shelter / Cover	Scattered large rocks (>30 cm) and small rocks (10-30 cm); scattered leaf litter; dense shrub/grass cover common.
Food Potential Over Entire Year	Seeding grass cover scattered; nectar/pollen producing plants scattered, including eucalypts.
Signs	No koala, glider or possum scratches or scats detected; frogs calling, including common froglet (<i>Crinia signifera</i>) and Peron’s tree frog (<i>Litoria peronii</i>). Birds observed in the vicinity comprised common urban species including eastern rosella (<i>Platycercus eximius</i>), magpie (<i>Cracticus tibicen</i>), magpie-lark (<i>Grallina cyanoleuca</i>), pied currawong (<i>Strepera graculina</i>), striated pardalote (<i>Pardalotus striatus</i>), superb fairy-wren (<i>Malurus cyaneus</i>). Cat (<i>Felis catus</i>) observed in reed bed.
Koala Food Trees	<i>E. camaldulensis</i> (scattered).
Health / Condition	Degraded
Notes	

<p>Survey Code FA2</p> <p>Location Reserve between Campbell Street and the railway line, Cowra</p> <p>Date 28/04/2015</p> <p>Latitude -33.846048</p> <p>Longitude 148.696189</p> <p>Assessed By DM, DL</p>	
General Site Description	
Landform	Gently undulating plain.
Soil	Red-brown loamy sand.
Mapped Vegetation	Yellow Box Woodland on flats and alluvial terraces of the slopes (DECC 2008).
Observed Vegetation	Yellow Box Open Woodland. Dominated by yellow box (<i>Eucalyptus melliodora</i>). Mid-storey dominated by African boxthorn (<i>Lycium ferocissimum</i>), with some recruitment of yellow box. Groundcover dominated by exotic species.
General Site Observations	Trees form dominant stratum (30-70% cover); isolated, semi-irregular patch, 4-5 ha; weeds frequent; disturbance associated with rail corridor, evidence of past timber cutting, bike tracks and weed ingress.
Fauna Habitat Observations	
Shelter / Cover	Scattered leaf litter; dense shrub/grass cover scattered; notable lack of logs (indicative of timber collecting) and hollows.
Food Potential Over Entire Year	Seeding grass cover common; nectar/pollen producing plants common, including eucalypts and African boxthorn; mistletoe scattered.
Signs	Macropod and rabbit scats frequent; no koala, glider or possum scratches or scats detected. Birds observed comprised common woodland species including eastern rosella (<i>Platycercus eximius</i>), black-faced cuckoo shrike (<i>Coracina novaehollandiae</i>), double-barred finch (<i>Taeniopygia bichenovii</i>), red wattlebird (<i>Anthochaera carunculata</i>), white-plumed honeyeater (<i>Lichenostomus penicillatus</i>), weebill (<i>Smicronis brevirostris</i>), welcome swallow (<i>Hirundo neoxena</i>), noisy miner (<i>Manorina melanocephala</i>) and the introduced common blackbird (<i>Turdus merula</i>).
Koala Food Trees	None detected.
Health / Condition	Poor.
Notes	Woodland may represent an EEC under the TSC Act, but unlikely to represent a TEC under the EPBC Act. No direct impacts anticipated.

<p>Survey Code FA3</p> <p>Location Lachlan River, proposed crossing location, Cowra</p> <p>Date 29/04/2015</p> <p>Latitude -33.850897</p> <p>Longitude 148.682542</p> <p>Assessed By DM, DL</p>	
General Site Description	
Landform	Stream bank.
Soil	Brown loamy sand.
Mapped Vegetation	Floodplain Complex (Central Lachlan) (DECC 2008).
Observed Vegetation	Floodplain Complex (Central Lachlan). Dominated by river red gum (<i>Eucalyptus camaldulensis</i>), with abundant river oak (<i>Casuarina cunninghamiana</i>), crack willow (<i>Salix fragilis</i>) and frequent black willow (<i>Salix nigra</i>). Mid-storey dominated by <i>Salix</i> spp. and blackberry (<i>Rubus anglocandicans</i>). Exotics dominate groundcover.
General Site Observations	Trees form dominant stratum (about 70% cover); linear patch shape (watercourse); connectivity relatively continuous; riparian corridor (encompassing both banks) approx. 90m wide; disturbance associated with rail bridge, rubbish dumping, regular human visitation, past clearing for overhead powerlines, occasional grazing, weed infestation.
Fauna Habitat Observations	
Shelter / Cover	Scattered small logs (10-50 cm); leaf litter common; dense shrub/grass cover scattered; notable lack of hollows, even in mature river red gums.
Food Potential Over Entire Year	Seeding grass cover scattered; fleshy fruiting plants scattered; nectar/pollen producing plants scattered.
Signs	Eastern grey kangaroo (<i>Macropus giganteus</i>), swamp wallaby (<i>Wallabia bicolor</i>), brushtail possum (<i>Trichosurus vulpecula</i>), feral European rabbit (<i>Oryctolagus cuniculus</i>) and black rat (<i>Rattus rattus</i>) observed. No koala scratches or scats detected. A diversity of waterfowl and woodland birds observed.
Koala Food Trees	<i>E. camaldulensis</i> (common).
Health / Condition	Poor.
Notes	Lower bank infested with willows (<i>Salix</i> spp.). Works may present an opportunity to manage weeds, stabilised banks and remove rubbish including car, fridge etc.

Survey Code

FA4

Location

70 m east of Airport Rd / Boundary Rd intersection, Cowra

Date

29/04/2015

Latitude

-33.847517

Longitude

148.654269

Assessed By

DM, DL



General Site Description

Landform

Gently undulating plain.

Soil

Red-yellow loam.

Mapped Vegetation

Non-remnant (DECC 2008).

Observed Vegetation

Non-remnant. Dominated by grey box (*Eucalyptus microcarpa*) with occasional yellow box (*E. melliodora*). Dominated by road-side plantings, interspersed with more mature, but potentially naturally occurring grey box and yellow box. No recruitment or mid-storey species. Groundcover dominated by exotic species.

General Site Observations

Trees form dominant stratum (about 30% cover); semi-isolated patch, <1 ha; linear patch shape (road), <35 m wide; weeds frequent; disturbance associated with vehicular and pedestrian traffic, slashing and weed ingress.

Fauna Habitat Observations

Shelter / Cover

Scattered large (>20 cm) and small (<20 cm) hollows, mostly alive; leaf litter common; notable lack of logs or dense shrub/grass cover.

Food Potential Over Entire Year

Seeding grass cover scattered; nectar/pollen producing plants scattered, comprising eucalypts.

Signs

No scats, tracks or other traces detected.

Koala Food Trees

None detected.

Health / Condition

Degraded.

Notes

Appendix C: Site Descriptions – Aquatic Assessment

Aquatic Assessment – Site Profile

Site Code: AQ1

Watercourse: Lachlan River, Cowra

Latitude: -33.850738

Longitude: 148.682227

Date: 28 April 2015



Upstream



Left Bank



Downstream



Right Bank

General Site Description

Geomorphology

Bank slope moderately inclined (7-18°). Defined bed and banks. Wetted width approximately 50m at proposed crossing location. Low substrate complexity, with the bed habitat comprised of gravel (80%) and sand (20%); and the edge habitat comprised of gravel (35%), sand (50%), silt (10%) and clay (5%). Stream bed observed to be highly mobile.

Riparian Vegetation

Riparian zone approximately 35 m on right bank and 25 m on left bank, with little bare ground, extensive grass cover, little/few shrubs, moderate cover of trees >10m high, some trees <10m high, and moderate cover of exotic species. Ground layer on the lower bank dominated by common couch (*Cynodon dactylon*), with occasional river clubrush (*Scheonoplectus validus*), giant sedge (*Cyperus exaltatus*) and common rush (*Juncus usitatus*). Upper bank dominated by exotic species including variegated thistle (*Silybum marianum*), purpletop (*Verbena bonariensis*), tall wheatgrass (*Lophopyrum ponticum*), wild oat (*Avena fatua*), Phalaris (*Phalaris aquatica*) and occasional natives including common couch (*Cynodon dactylon*) and dock (*Rumex* spp.).

Erosion Risk

Low – banks appear to be moderately stable.

Aquatic Flora, Fauna and Breeding Habitat

Macrophytes restricted to lower velocity edge habitat, including little/scattered river clubrush (*Schoenoplectus validus*), giant sedge (*Cyperus exaltatus*) and common rush (*Juncus usitatus*). At the time of the site visit, in-stream habitat comprised pool habitat with low flow (<watermark), various depths (<0.1 to 1.2 m) and large woody debris. Edge habitat attributes included little (1-10%) periphyton, filamentous algae, macrophytes, bank overhang vegetation and trailing bank vegetation, as well as blanketing silt. The study reach provides semi-permanent habitat for aquatic fauna, although presumably impacted by regulated flows (Wyangala Dam) and cold water releases. The reach provides marginal foraging habitat for turtles and platypus. Unlikely breeding habitat for platypus (*Ornithorhynchus anatinus*) due to apedal bank sediments and soils being unsuitable for burrow construction. No platypus burrows detected. Detected fishes include northern river blackfish (*Gadopsis marmoratus*), mountain galaxias (*Galaxias olidus*), carp gudgeon (*Hypseleotris* sp.) and

common carp (*Cyprinus carpio*).

Threatened Flora and Fauna

No threatened aquatic flora or fauna species detected during the site visit 28 April 2015.

Visual Assessment of Disturbance

Water quality – no evidence of disturbance (0).

Instream – little disturbance (1), attributed to rubbish (fire extinguisher, scooter etc.), alien fish species (common carp).

Riparian zone – high disturbance (3), attributed to previous clearing and development of rail, power and road infrastructure exotic plant invasion (willows, blackberry etc.) and lack of native riparian understorey.

Catchment assessment – moderate disturbance (2), attributed to river regulation, grazing, direct access by stock, and other agricultural pursuits.

Aquatic Values

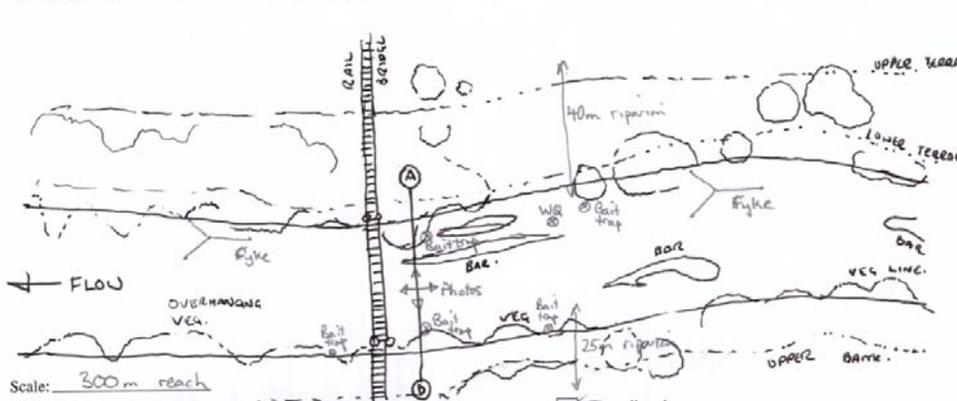
Macroinvertebrates collected from the edge habitat only, as no riffle habitat was encountered.

Macroinvertebrate richness: 20. PET richness: 6. SIGNAL2 score: 4.45. Level of Disturbance: Moderate-Low.

Overall Aquatic Values

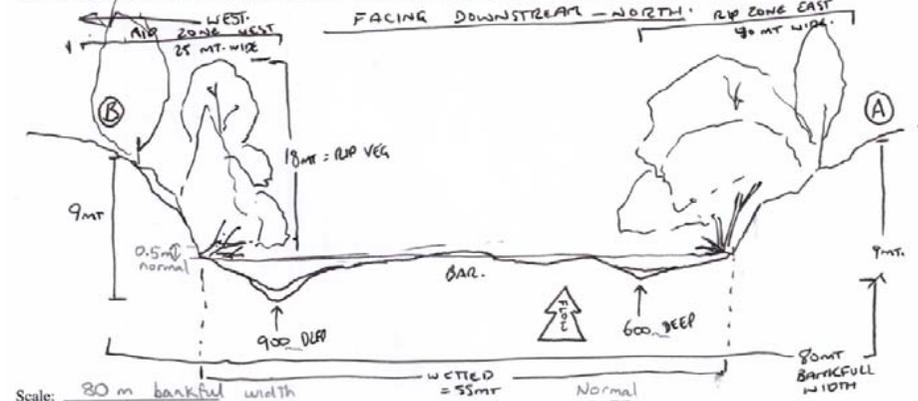
Moderate.

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH



- Scale: 300m reach
- Please indicate on sketch and tick off each item when completed.
- Biological sampling sites for each habitat type.
 - Water quality measurement and water sample collection sites.
 - Location from where photograph(s) taken.
 - Flow direction
 - Location of cross-sectional profile sketch.
 - Riparian vegetation (include approx. heights).
 - Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



- Scale: 80m bankfull width
- wetted = 55m Normal = 57m
- Please indicate on sketch and tick off each item when completed.
- Bankfull bank height
 - Bankfull stream width
 - Stream wetted width
 - "Normal" wetted width
 - Riparian vegetation height
 - Riparian zone width
 - Water depth

Appendix D: Flora Species Detected

Table 7 Flora species recorded in the Study area 27-29 April 2015

Family name	Scientific name	Common name
AMARANTHACEAE	<i>Alternanthera pungens</i> *	Khaki Weed
ANACARDIACEAE	<i>Schinus areira</i> *	Pepper Tree
ANTHERICACEAE	<i>Dichopogon fimbriatus</i>	Nodding Chocolate Lily
	<i>Arthropodium minus</i>	Small Vanilla Lily
APIACEAE	<i>Daucus glochidiatus</i>	Australian Carrot
ARALIACEAE	<i>Hedera helix</i> *	English Ivy
ASPARAGACEAE	<i>Asparagus officinalis</i>	Asparagus
ASTERACEAE	<i>Xanthium spinosum</i> *	Bathurst Burr
	<i>Cymbonotus lawsonianus</i>	Bear' Ear
	<i>Arctotheca calendula</i> *	Capeweed
	<i>Bidens pilosa</i> *	Cobblers Ticks/Pegs
	<i>Sonchus oleraceus</i> *	Common Sowthistle
	<i>Taraxacum officinale</i> *	Dandelion
	<i>Actinobole uliginosum</i>	Flannel Cudweed
	<i>Xanthium occidentale</i> *	Noogoora Burr
	<i>Lactuca serriola</i> *	Prickly Lettuce
	<i>Calotis cuneifolia</i>	Purple Burr Daisy
	<i>Carthamus lanatus</i> *	Saffron Thistle
	<i>Tragopogon porrifolius</i> *	Salsify
	<i>Onopordum acanthium</i> *	Scotch Thistle
	<i>Chondrilla juncea</i> *	Skeleton Weed
	<i>Hypochaeris glabra</i> *	Smooth Catsear
	<i>Cirsium vulgare</i> *	Spear Thistle
	<i>Centaurea calcitrapa</i> *	Star Thistle
	<i>Conyza albida</i>	Tall Fleabane
	<i>Silybum marianum</i> *	Variegated Thistle
	<i>Calotis lappulacea</i>	Yellow Burr Daisy
<i>Chrysocephalum apiculatum</i>	Yellow Buttons/ Common Everlasting	
BORAGINACEAE	<i>Heliotropium amplexicaule</i> *	Blue Heliotrope
	<i>Echium plantagineum</i> *	Patterson's Curse
BRASSICACEAE	<i>Lepidium pseudohyssopifolium</i>	Peppercress
	<i>Capsella bursa-pastoris</i> *	Shepherd's Purse
CAMPANULACEAE	<i>Wahlenbergia stricta</i>	Tall Bluebell
CASUARINACEAE	<i>Casuarina cunninghamiana</i>	River She-oak
	<i>Allocasuarina diminuta</i>	Shrubby She-oak
CHENOPODIACEAE	<i>Sclerolaena muricata</i>	Black Roly-poly
	<i>Einadia nutans</i>	Climbing Saltbush
CLUSIACEAE	<i>Hypericum perforatum</i> *	St. John's Wort
CUCURBITACEAE	<i>Cucumis myriocarpus</i>	Paddy Melon
CUPRESSACEAE	<i>Callitris endlicheri</i>	Black Cypress Pine
CYPERACEAE	<i>Cyperus eragrostis</i>	Umbrella Sedge
EUPHORBIACEAE	<i>Chamaesyce drummondii</i>	Caustic Weed
FABOIDEAE	<i>Medicago polymorpha</i>	Burr Medic
	<i>Hardenbergia violacea</i>	False Sarsaparilla
	<i>Trifolium arvense</i> *	Haresfoot Clover

	<i>Medicago sativa</i> *	Lucerne
	<i>Medicago sp</i>	Medic
	<i>Trifolium angustifolium</i> *	Narrow-leaf Clover
	<i>Glycine clandestina</i>	Twining Glycine
	<i>Trifolium repens</i> *	White Clover
FUMARIACEAE	<i>Fumaria bastardii</i> *	Bastard Fumitory
GERANIACEAE	<i>Geranium solanderi</i>	Australian Cransbill (Native Geranium)
	<i>Erodium cicutarium</i> *	Storksbill
JUNCACEAE	<i>Juncus remotiflorus</i>	Rush
LAMIACEAE	<i>Marrubium vulgare</i> *	Horehound
	<i>Salvia verbenaca</i>	Wild Sage
LINACEAE	<i>Linum usitatissimum</i> *	Flax
LOMANDRACEAE	<i>Lomandra multiflora</i>	Many-flowered Mat-rush
	<i>Amyema miquelii</i>	Box Mistletoe
MALVACEAE	<i>Cotoneaster franchetii</i> *	
	<i>Sida corrugata</i>	Corrugated Sida
	<i>Modiola caroliniana</i> *	Redflowered Mallow
	<i>Melia azedarach</i>	White Cedar
MIMOSOIDEAE	<i>Acacia buxifolia</i>	Box-leaf Wattle
	<i>Acacia doratoxylon</i>	Currawang
	<i>Acacia deanei</i>	Dean's Wattle
	<i>Acacia dealbata</i>	Silver Wattle
	<i>Acacia decora</i>	Western Golden Wattle
MORACEAE	<i>Ficus sp.</i>	Fig *
MYOPORACEAE	<i>Eremophila debilis</i>	Amulla
MYRTACEAE	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum
	<i>Eucalyptus microcarpa</i>	Grey Box
	<i>Eucalyptus sideroxylon</i>	Mugga Ironbark
	<i>Eucalyptus macrorhyncha</i>	Red Stringybark
	<i>Callistemon sieberi</i>	River Bottlebrush
	<i>Eucalyptus camaldulensis</i>	River Red Gum
	<i>Eucalyptus dealbata</i>	Tumbledown Gum
	<i>Eucalyptus melliodora</i>	Yellow Box
OLEACEAE	<i>Ligustrum sinense</i>	Small Leaf Privet *
OXALIDACEAE	<i>Oxalis perennans</i>	Grassland Wood Sorrel
	<i>Oxalis corniculata</i> *	Yellow Wood Sorrel
PINACEAE	<i>Pinus radiata</i>	Radiata Pine
PLANTAGINACEAE	<i>Plantago lanceolata</i> *	Ribwort (lamb's tongue)
POACEAE	<i>Aristida vagans</i>	3 Awned Wiregrass/Speargrass
	<i>Eragrostis curvula</i> *	African Lovegrass
	<i>Ehrharta longiflora</i>	Annual Veldtgrass
	<i>Hordeum leporinum</i> *	Barley Grass
	<i>Dactylis glomerata</i> *	Cocksfoot
	<i>Elymus scaber</i>	Common Wheatgrass
	<i>Austrostipa setacea</i>	Corkscrew Grass
	<i>Cynodon dactylon</i>	Couch Grass
	<i>Enteropogon acicularis</i>	Curly Windmill Grass
	<i>Aira elegantissima</i>	Delicate Hairgrass

	<i>Panicum effusum</i>	Hairy Panic
	<i>Themeda australis</i>	Kangaroo Grass
	<i>Pennisetum cladestinum</i> *	Kikuyu
	<i>Phalaris minor</i> *	Lesser Canary Grass
	<i>Panicum decompositum</i>	Native Millet
	<i>Avena sativa</i>	Oats
	<i>Paspalum dilatatum</i> *	Paspalum
	<i>Lolium perenne</i> *	Perennial Ryegrass
	<i>Phalaris aquatica</i> *	Phalaris
	<i>Bromus cartharticus</i> *	Prairie Grass
	<i>Aristida ramosa</i>	Purple Wiregrass
	<i>Briza maxima</i> *	Quaking Grass
	<i>Rytidosperma pallidum</i>	Redanther / Silvertop Wallaby Grass
	<i>Bothriochloa macra</i>	Red-leg Grass
	<i>Austrostipa scabra</i>	Rough Speargrass
	<i>Austrostipa verticillata</i>	Slender Bamboo Grass
	<i>Paspalidium gracile</i>	Slender Panic
	<i>Poa sieberiana</i>	Snowgrass
	<i>Bromus hordeaceus</i> *	Soft Brome
	<i>Sorghum bicolor</i> *	Sorghum
	<i>Digitaria divaricatissima</i>	Spreading Umbrella Grass
	<i>Vulpia bromoides</i> *	Squirrel Tail Fescue
	<i>Microlaena stipoides</i>	Weeping Grass
	<i>Eragrotis parviflora</i>	Weeping Lovegrass
	<i>Sporobolus creber</i>	Western Rat's-tail Grass
	<i>Avena fatua</i> *	Wild Oats
	<i>Chloris truncata</i>	Windmill Grass
POLYGONACEAE	<i>Rumex crispus</i> *	Curled Dock
	<i>Persicaria lapathifolia</i> *	Pale Knotweed
	<i>Acetosella vulgaris</i> *	Sheep Sorrel
	<i>Rumex brownii</i>	Slender/Swamp Dock
PORTULACACEAE	<i>Portulaca oleracea</i>	Common Pigweed
PROTEACEAE	<i>Grevillea rosmarinifolia</i>	Rosemary Grevillea
	<i>Grevillea robusta</i>	Silky Oak
ROSACEAE	<i>Rubus fruticosus</i> sp. *	Blackberry complex
	<i>Rosa rubiginosa</i> *	Sweet Briar
SALICACEAE	<i>Salix fragilis</i> *	Crack Willow
	<i>Populus nigra</i> *	Lombardy Poplar
	<i>Salix babylonica</i> *	Weeping Willow
SAPINDACEAE	<i>Acer negundo</i> *	Box Elder
SCROPHULARIACEAE	<i>Veronica plebeia</i>	Trailing Speedwell
	<i>Verbascum virgatum</i> *	Twiggy Mullein
SIMAROUBACEAE	<i>Ailanthus altissima</i> *	Tree of Heaven
SINOPTERIDACEAE	<i>Cheilanthes sieberi</i>	Rock Fern
SOLANACEAE	<i>Lycium ferocissimum</i> *	African Boxthorn
	<i>Solanum nigrum</i> *	Blackberry Nightshade
	<i>Datura stramonium</i> *	Common Thornapple
	<i>Solanum elaeagnifolium</i> *	Silver-leaved Nightshade
STERCULIACEAE	<i>Brachychiton populneus</i>	Kurrajong

TYPHACEAE	<i>Typha domingensis</i>	Cumbungi
URTICACEAE	<i>Urtica incisa</i>	Scrub/Stinging Nettle
VERBENACEAE	<i>Verbena bonariensis</i>	Purpletop
ZAMIACEAE	<i>Macrozamia sp.</i>	Cycad
ZYGOPHYLLACEAE	<i>Tribulus terrestris</i> *	Cathead

Note: *denotes introduced species

Appendix E: Fauna Species Detected

Table 8 Fauna species recorded in the Study area 27-29 April 2015

Scientific name	Common name
Amphibians	
<i>Crinia parinsignifera</i>	Brown Froglet
<i>Crinia signifera</i>	Brown Froglet
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog
<i>Litoria peronii</i>	Peron's Tree Frog
Reptiles	
<i>Cryptoblepharus pannosus</i>	Ragged snake-eyed skink
<i>Carlia tetradactyla</i>	Southern rainbow skink
<i>Egernia striolata</i>	Tree Skink
Mammals	
<i>Trichosurus vulpecula</i>	Common Brushtail Possum
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Wallabia bicolor</i>	Swamp Wallaby
<i>Rattus rattus</i> *	Black Rat
<i>Vulpes vulpes</i> *	Fox
<i>Felis catus</i> *	Feral Cat
<i>Oryctolagus cuniculus</i> *	Rabbit
<i>Lepus capensis</i>	Brown Hare
Birds	
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
<i>Elanus axillaris</i>	Black-shouldered Kite
<i>Haliastur sphenurus</i>	Whistling Kite
<i>Chenonetta jubata</i>	Wood Duck
<i>Anas superciliosa</i>	Pacific Black Duck
<i>Fulica atra</i>	Eurasian Coot
<i>Vanellus miles</i>	Masked Lapwing
<i>Ocyphaps lophotes</i>	Crested Pigeon
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
<i>Eolophus roseicapilla</i>	Galah
<i>Platycercus elegans</i>	Crimson Rosella
<i>Platycercus eximius</i>	Eastern Rosella
<i>Ninox boobook</i>	Southern Boobook
<i>Dacelo novaeguineae</i>	Laughing Kookaburra
<i>Hirundo neoxena</i>	Welcome Swallow
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike
<i>Petroica goodenovii</i>	Red-capped Robin
<i>Eopsaltria australis</i>	Eastern Yellow Robin
<i>Colluricincla harmonica</i>	Grey Shrike-thrush
<i>Rhipidura albiscapa</i>	Grey Fantail
<i>Rhipidura leucophrys</i>	Willy Wagtail
<i>Cinclorhamphus mathewsi</i>	Rufous Songlark
<i>Malurus cyaneus</i>	Superb Blue Wren
<i>Sericornis frontalis</i>	White browed Scrubwren
<i>Smicronis brevirostris</i>	Weebill
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill

<i>Anthochaera carunculata</i>	Red Wattlebird
<i>Philemon corniculatus</i>	Noisy Friarbird
<i>Manorina melanocephala</i>	Noisy Miner
<i>Lichenostomus chrysops</i>	Yellow Faced Honeyeater
<i>Lichenostomus leucotis</i>	White-eared Honeyeater
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater
<i>Pardalotus striatus</i>	Striated Pardalote
<i>Passer domesticus</i> *	Sparrow
<i>Taeniopygia guttata</i>	Zebra Finch
<i>Sturnus vulgaris</i> *	Common Starling
<i>Grallina cyanoleuca</i>	Peewee/Magpie-lark
<i>Artamus cyanopterus</i>	Dusky Woodswallow
<i>Cracticus nigrogularis</i>	Pied Butcherbird
<i>Gymnorhina tibicen</i>	Australian Magpie
<i>Strepera graculina</i>	Pied Currawong
<i>Corvus coronoides</i>	Australian Raven

Note: *denotes introduced species

Appendix F: Assessments of Significance – Terrestrial Fauna

Assessments of Significance – Terrestrial Fauna

The EP&A Act specifies a set of seven factors which must be considered by decision-makers in assessing the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats. These factors are collectively referred to as the '7 part test'.

In January 2007, the Australian and NSW Governments signed a Bilateral Agreement which allows the assessment regimes under the EP&A Act (Part 4 and 5 of the EP&A Act) to be automatically accredited under the EPBC Act. This means that separate assessment processes are not required. Where a proposed development is in the potential range of a listed threatened species, population or ecological community under the TSC Act and/or EPBC Act, the '7 part test' applies (DPI 2013).

The following seven factors have been used to determine whether there would be a significant impact on any of the TSC Act or EPBC Act listed threatened or migratory species (or their habitats) found to be in or likely to be using the study area and where there is potential for the CHVB to impact on these species, including:

- Parrots:
 - Swift parrot (*Lathamus discolor*) – Endangered (EPBC Act and TSC Act)
 - Superb parrot (*Polytelis swainsonii*) – Vulnerable (EPBC Act and TSC Act)
- Woodland birds:
 - Regent honeyeater (*Anthochaera phrygia*) – Endangered (EPBC Act and TSC Act)
 - Brown treecreeper - eastern subspecies (*Climacteris picumnus victoriae*) – Vulnerable (TSC Act)
 - Black-chinned honeyeater - eastern subspecies (*Melithreptus gularis gularis*) – Vulnerable (TSC Act)
 - Rainbow bee-eater (*Merops ornatus*) – Migratory (EPBC Act)
 - Satin flycatcher (*Myiagra cyanoleuca*) – Migratory (EPBC Act)
 - Grey-crowned babbler - eastern subspecies (*Pomatostomus temporalis temporalis*) – Vulnerable (TSC Act)
- Raptors:
 - Spotted harrier (*Circus assimilis*) – Vulnerable (TSC Act)
 - Black falcon (*Falco subniger*) – Vulnerable (TSC Act)
 - Little eagle (*Hieraaetus morphnoides*) – Vulnerable (TSC Act)
 - Square-tailed kite (*Lophoictinia isura*) – Vulnerable (TSC Act)
 - Barking owl (*Ninox connivens*) – Vulnerable (TSC Act)

Parrots – Swift Parrot, Superb Parrot

- a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Threatened parrots that have been recorded within 10 km of the study area and whose habitat occurs within the study area include the swift parrot (*Lathamus discolor*) and superb parrot (*Polytelis swainsonii*) (Section 5.3). These species nest in tree hollows and forage on seeds, herbaceous plants, fruits, berries, nectar, buds, flowers, insects and grain.

Swift Parrot

The swift parrot breeds only in Tasmania (Higgins 1999; Swift Parrot Recovery Team 2001, cited in DotE 2015g). This species is highly unlikely to breed in the study area. Development of the proposed CHVB is unlikely to affect the life cycle of the swift parrot such that a viable local population is likely to be placed at risk of extinction.

Superb Parrot

The key breeding populations of the superb parrot occur in the Riverina and South-west Slopes Region of NSW (DotE 2015h). The superb parrot breeds between September and January, nesting in the hollows of large trees (dead or alive) in tall riparian River Red Gum Forest or Woodland, open Box-Gum Woodland or isolated paddock trees including Blakely's Red Gum, Yellow Box, Apple Box and Red Box (OEH 2014a). Although the study area contains hollow-bearing trees, it is located outside of the key breeding area and is unlikely to be an important area for breeding pairs of superb parrots. It is, however, possible that occasional breeding could occur in the study area. Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain an occupied nest of the superb parrot would be left untouched until young have fully fledged and vacated the immediate area. Any disruption on breeding is not likely to impact on the life cycle of the superb parrot such that it would be placed at risk of extinction.

- b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable

- d) In relation to the habitat of a threatened species, population or ecological community:**

- i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

- i) A small number of trees bearing small hollows were recorded within the study area and would require removal as part of the CHVB works. This includes a river red gum (*Eucalyptus camaldulensis*) on the western bank of the Lachlan River, two river red gums and three grey box (*E. microcarpa*) between the Lachlan River and the Mid Western Highway.

Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. This vegetation is dominated by agricultural pasturelands and associated grasslands. The works also require the removal of approximately 30 isolated trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River, 0.2 ha of riparian vegetation mapped as Floodplain Complex, 50 mature tree plantings on Airport Road, and 50 mature tree plantings on Boundary Road.

- ii) Removal of riparian vegetation and construction of the CHVB river crossing would reduce connectivity of vegetation along the Lachlan River. However, the proposed bridge would reduce connectivity by only a minor degree, and is not likely to present a barrier to the movement of parrots. As such, the proposal is unlikely to isolate or fragment habitat for either of these species.
- iii) Considering the limited vegetation removal required and the extent of similar vegetation in the broader area, particularly along the riparian corridor of the Lachlan River, impacts are considered to be minor.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat declarations in force under the TSC Act at the time of this assessment comprise those for:

- Gould's Petrel
- Little penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve
- Wollemi Pine

No areas of critical habitat have been declared for any threatened fauna species with the potential to occur in the Study area.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan

A recovery plan is in place for the superb parrot (DSE 2011). The specific objectives of the recovery plan are to:

- determine population trends in the superb parrot
- increase the level of knowledge of the super parrot's ecological requirements
- develop and implement threat abatement strategies (so that the decline in abundance is reversed and there is an overall increase in population size)

- increase community involvement in and awareness of the super parrot recovery program.

The proposal would not interfere with the objectives of the recovery plan for the superb parrot.

A recovery plan is in place for the swift parrot (Saunders and Tzaros 2011). The overall objectives of the recovery plan are to:

- prevent further decline of the swift parrot population
- to achieve a demonstrable sustained improvement in the quality and quantity of swift parrot habitat to increase carrying capacity.

The proposal would not interfere with the objectives of the recovery plan for the superb parrot.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes (KTPs) relevant to terrestrial fauna are identified in Schedule 3 of the TSC Act. KTPs relevant to the proposal include:

- Clearing of native vegetation – Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. The works require the removal of approximately:
 - 30 isolated native trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River
 - 0.2 ha of riparian vegetation mapped as Floodplain Complex
 - 50 mature native tree plantings on Airport Road
 - 50 mature native tree plantings on Boundary Road.

The proposal may reduce foraging habitat for the swift parrot and superb parrot. However, the area impacted is small, and is not unique in a local nor regional context. Suitable habitat resources for the swift parrot and superb parrot occur as contiguous riparian vegetation along the Lachlan River and in other woodland areas adjoining the proposed CHVB (Figure 6). Less impacted remnant patches of vegetation occur within the broader region which are likely better suited to the swift parrot and superb parrot.

- Loss of hollow-bearing trees – The proposed works require the removal of approximately ten isolated hollow-bearing trees. Loss of hollow-bearing trees would reduce the availability of potential breeding habitat for the swift parrot and superb parrot. The swift parrot breeds only in Tasmania (Higgins 1999; Swift Parrot Recovery Team 2001, cited in DotE 2015g) and the study area is outside of the key breeding area for the superb parrot. The hollow-bearing trees occurring within the study area are unlikely to be an important breeding resource for either the swift parrot or superb parrot.

Conclusion

The proposal would impact potential habitat for the swift parrot and superb parrot through the removal of sheltering and foraging habitat. However, the area to be impacted is small in a local and regional context and is not core habitat for either species. Furthermore, a pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of any threatened parrot species occurring within the study area. In conclusion, the proposal is highly unlikely to have a significant impact on threatened parrots and as such a Species Impact Statement is not required.

Woodland birds – Regent honeyeater, brown treecreeper, black-chinned honeyeater, rainbow bee-eater, satin flycatcher, grey-crowned babbler

- a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Woodland birds include those that rely on forested areas for nesting or foraging purposes and may utilise vegetation within the study area on occasion. Threatened woodland birds that have been recorded within 10 km of the study area and whose habitat occurs within the study area include the regent honeyeater (*Anthochaera phrygia*), brown treecreeper - eastern subspecies (*Climacteris picumnus victoriae*), black-chinned honeyeater - eastern subspecies (*Melithreptus gularis gularis*), and grey-crowned babbler - eastern subspecies (*Pomatostomus temporalis temporalis*) (Section 5.3). Migratory woodland birds that have been recorded within 10 km of the study area and whose habitat occurs within the study area include the rainbow bee-eater (*Merops ornatus*) and satin flycatcher (*Myiagra cyanoleuca*) (Section 5.3).

Regent Honeyeater

The total known population of the regent honeyeater has been estimated at between 800 and 2000 (DotE 2015i). This species breeds almost year round, from May to March, presumed to correspond with regional patterns in the flowering of key eucalypt and mistletoe species (DotE 2015i). The regent honeyeater usually nests in the canopy of forests or woodlands, and in the crowns of tall trees, mostly eucalypts, building cup-shaped nests commonly made from strips of bark or dry grass or both, bound with spider web (DotE 2015i). Young generally fledge 13-17 days after hatching. Breeding pairs may re-nest after a successful or failed breeding attempt, sometimes re-nesting several kilometres away from the site of their previous breeding attempt (DotE 2015i). Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. The proposed works are unlikely to have an adverse effect on the lifecycle of the regent honeyeater to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Brown Treecreeper (eastern subspecies)

The population density of the eastern subspecies of brown treecreeper has been greatly reduced over much of its range, with major declines in central NSW and the northern and southern tablelands (OEH 2014b). Hollows in standing dead or live trees and tree stumps are essential for nesting (OEH 2014b). Approximately ten hollow-bearing trees would be removed as part of the works. Though removal of these trees would reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain an occupied nest of the brown treecreeper would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the brown treecreeper to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Black-chinned Honeyeater (eastern subspecies)

The black-chinned honeyeater (eastern subspecies) occupies mostly upper levels of drier forests or woodlands dominated by box and ironbark eucalypts, especially mugga ironbark (*Eucalyptus sideroxylon*), white Box (*E. albens*), inland grey box (*E. microcarpa*), yellow box (*E.*

meliiodora), Blakely's red gum (*E. blakelyi*) and forest red gum (*E. tereticornis*). The nest is placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. It is a compact, suspended, cup-shaped nest (OEH 2014c). Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain occupied nests of black-chinned honeyeaters or other threatened species would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the black-chinned honeyeater to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Grey-crowned Babbler - Eastern Subspecies

The Grey-crowned babbler (eastern subspecies) inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains (OEH 2014d). This species lives in family groups that consist of a breeding pair and young from previous breeding seasons. This species builds and maintains several conspicuous, dome-shaped stick nests about the size of a football that are usually located in shrubs or sapling eucalypts, although may be built in the outermost leaves of low branches of large eucalypts (OEH 2014d). A nest is used as a dormitory for roosting each night. Breeding occurs between July and February, with two to three eggs laid and incubated by the female (OEH 2014d). Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain continuously occupied nests of the grey-crowned babbler (i.e. incubating eggs or hatchlings) would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the grey-crowned babbler to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Rainbow Bee-eater

The Rainbow Bee-eater is a regular summer migrant to southern Australia from September to April (Morcombe 2003). In Australia, the breeding season extends from August to January (DotE 2015j). The nests are typically concentrated together in loose colonies, although in some instances pairs will nest solitarily (DotE 2015j). The nest is located in an enlarged chamber at the end of a large burrow or tunnel that is excavated in flat or sloping ground, in the banks of rivers, creeks or dams, roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces (DotE 2015j). Though earthworks and land re-forming associated with the proposed CHVB may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of migratory species. Any earthen habitat observed to contain occupied nests of Rainbow Bee-eaters would be cordoned off until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the Rainbow Bee-eater to the extent that a viable local or migrant population of the species is likely to be placed at risk of extinction.

Satin Flycatcher

The Satin Flycatcher is a summer breeding migrant to eastern and south-eastern Australia, wintering in north-east Queensland and New Guinea (Morcombe 2003). In NSW, eggs have been recorded between November and January (DotE 2015k). This species prefers to nest in a fork of outer branches of trees, such as paperbarks, eucalypts and banksias (DotE 2015k). Though vegetation clearing for the proposed CHVB may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of migratory species. Any trees observed to contain occupied nests of Satin Flycatcher would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the Satin Flycatcher to the extent that a viable local or migrant population of the species is likely to be placed at risk of extinction.

- b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable

- d) In relation to the habitat of a threatened species, population or ecological community:**
- i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
 - ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
 - iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

- iv) A small number of trees bearing small hollows were recorded within the study area and would require removal as part of the CHVB works. This includes a river red gum (*Eucalyptus camaldulensis*) on the western bank of the Lachlan River, two river red gums and three grey box (*E. microcarpa*) between the Lachlan River and the Mid Western Highway.

Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. This vegetation is dominated by agricultural pasturelands and associated grasslands. The works also require the removal of approximately 30 isolated trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River, 0.2 ha of riparian

vegetation mapped as Floodplain Complex, 50 mature tree plantings on Airport Road, and 50 mature tree plantings on Boundary Road.

- v) Removal of riparian vegetation and construction of the CHVB river crossing would reduce connectivity of vegetation along the Lachlan River. However, the proposed bridge would reduce connectivity by only a minor degree, and is not likely to present a barrier to the movement of woodland birds. As such, the proposal is unlikely to isolate or fragment habitat for any of these species.
- vi) Considering the limited vegetation removal required and the extent of similar vegetation in the broader area, particularly along the riparian corridor of the Lachlan River, impacts are considered to be minor.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat declarations in force under the TSC Act at the time of assessment comprise those for:

- Gould's Petrel
- Little penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve
- Wollemi Pine

No areas of critical habitat have been declared for any threatened fauna species with the potential to occur in the Study area.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan

Regent Honeyeater

A recovery plan is in place under the EPBC Act for the Regent Honeyeater (DNRE 1999). The long-term objectives of the recovery plan are to:

- Ensure that the species persists in the wild.
- Achieve a down-listing from nationally endangered to vulnerable by stabilising the population and securing habitat extent and quality in the main areas of occupancy.
- Achieve increasing reporting rates (5%) in areas previously used regularly, e.g. Munghorn Gap (NSW), Bendigo, north-east Melbourne, Eildon area (VIC).

The specific objectives of the recovery plan for the Regent Honeyeater are to:

- Effectively organise and administer the recovery effort to ensure that recovery plan objectives are met
- Maintain and enhance the value of Regent Honeyeater habitat at the key sites and throughout the former range, by active participation in land-use planning processes and by active vegetation rehabilitation at strategic sites
- Monitor trends in the Regent Honeyeater population size and dispersion across its range to allow assessment of the efficacy of management actions
- Facilitate research on strategic questions which will enhance the capacity to achieve the long-term objectives. In particular, determine the whereabouts of Regent Honeyeaters during the non-breeding season and during breeding season absences from known sites. Identify important sites and habitat requirements at these times.
- Maintain and increase community awareness, understanding and involvement in the recovery effort

- Maintain the captive population of Regent Honeyeaters at a size which will provide adequate stock to: provide insurance against the demise of the wild population; continuously improve captive-breeding and husbandry techniques, provide adequate stock for trials of release strategies; and maintain 90% of the wild heterozygosity in the captive population.

The proposal would not interfere with either the long-term or specific objectives of the recovery plan for the Regent Honeyeater.

No Recovery Plans or Threat Abatement Plans were in place for the Brown Treecreeper, Black-chinned Honeyeater, Grey-crowned Babbler, Rainbow Bee-eater or Satin Flycatcher at the time of assessment.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes (KTPs) relevant to terrestrial fauna are identified in Schedule 3 of the TSC Act. KTPs relevant to the proposal include:

- Clearing of native vegetation – Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. The works require the removal of approximately:
 - 30 isolated native trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River
 - 0.2 ha of riparian vegetation mapped as Floodplain Complex
 - 50 mature native tree plantings on Airport Road
 - 50 mature native tree plantings on Boundary Road.

This would reduce potential habitat for woodland birds that may utilise this vegetation as a nesting or foraging resource. However, the area impacted is small, and is not unique in a local or regional context. Suitable habitat resources for threatened and migratory woodland birds occur as contiguous riparian vegetation along the Lachlan River and in other woodland areas adjoining the proposed CHVB (Figure 6). Less impacted remnant patches of vegetation occur within the broader region which are likely better suited to woodland birds.

- Loss of hollow-bearing trees – The proposed works require the removal of six isolated hollow-bearing trees. Loss of hollow-bearing trees would reduce the availability of potential breeding habitat for hollow-nesting woodland birds such as the Brown Treecreeper. The hollow-bearing trees occurring within the study area are unlikely to be an important breeding resource for the brown treecreeper. Notwithstanding, a pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain an occupied nest of the brown treecreeper or other threatened species would be left untouched until young have fully fledged and vacated the immediate area. In such a case, nest boxes would be considered for placement into nearby retention areas as an attempt to offset impacted tree hollows for subsequent breeding events.

Conclusion

The proposal would impact potential habitat for threatened and migratory woodland birds through the removal of potential breeding, sheltering and foraging habitat. However, the area to

be impacted is small in both a local and regional context and unlikely to represent core habitat for any of these species. Pre-clearance fauna surveys/checks would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain an active breeding place of a threatened woodland bird would be left untouched until young have fully fledged and vacated the immediate area. In the event of a threatened woodland bird species having been observed utilising hollows of the study area for breeding purposes, nest boxes would be placed into nearby retention areas as an attempt to offset impacted hollows for subsequent breeding events. In conclusion, the proposal is highly unlikely to have a significant impact on threatened woodland birds and as such a Species Impact Statement is not required.

Raptors – Spotted Harrier, Black Falcon, Little Eagle, Square-tailed Kite, Barking Owl

- a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Raptors, also known as birds of prey, include both diurnal and nocturnal species that hunt and feed on other animals. Threatened raptors that have been recorded within 10 km of the study area and whose habitat occurs within the study area include the spotted harrier (*Circus assimilis*), black falcon (*Falco subniger*), little eagle (*Hieraaetus morphnoides*), square-tailed kite (*Lophoictinia isura*) and barking owl (*Ninox connivens*) (Section 5.3).

Spotted harrier

The spotted harrier occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe (OEH 2012b). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (OEH 2012b). This species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months (OEH 2012b). No raptor nests were observed within the study area during field surveys undertaken 27-29 April 2015. Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain occupied nests of spotted harrier would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the spotted harrier to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Black falcon

The black falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees (NSW Scientific Committee 2013). It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. In agricultural landscapes the black falcon tends to nest in healthy riparian woodland remnants with diverse avifauna prey (Debus et al. 2005, cited in NSW Scientific Committee 2013). Breeding pairs of the black falcon use the same breeding territories in successive years and nest in old sticks, typically built by corvids (in this vicinity of the CHVB this would be ravens) or sometimes other raptor species, in the top of emergent trees in woodland, particularly riparian woodland. Eggs are laid between winter and late spring, with young fledging 11-12 weeks thereafter (NSW Scientific Committee 2013). No raptor nests were observed within the study area during field surveys undertaken 27-29 April 2015. Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain nests occupied by black falcon would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the black falcon to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Little Eagle

The little eagle occupies eucalypt forest, woodland or open woodland, and occasionally she-oak or *Acacia* woodlands and riparian woodlands of interior NSW, where it preys on birds, reptiles

and mammals, occasionally adding large insects and carrion (OEH 2015b). This species nests in tall living trees within a remnant patch, where breeding pairs build a large stick nest in winter. The female lays two or three eggs during spring, and young fledge in early summer (OEH 2015b). No raptor nests were observed within the study area during field surveys undertaken 27-29 April 2015. Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain nests occupied by little eagle would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the little eagle to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Square-tailed Kite

The square-tailed kite is a regular resident along the major west-flowing river systems, occurring in a variety of timbered habitats including dry woodlands and open forests, but with a particular preference for timbered watercourses (OEH 2014e). It is a specialist hunter of passerines, especially honeyeaters, particularly nestlings, as well as insects in the tree canopy (OEH 2014e). Breeding occurs from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. No raptor nests were observed within the study area during field surveys undertaken 27-29 April 2015. Though removal of vegetation may reduce the extent of potential breeding habitat, pre-clearance fauna surveys by an ecologist would negate direct impacts. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain nests occupied by square-tailed kite would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the little eagle to the extent that a viable local population of the species is likely to be placed at risk of extinction.

Barking Owl

The barking owl inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas (OEH 2014f). The barking owl is sometimes able to successfully breed along timbered watercourses in heavily cleared habitats due to the higher density of prey on these fertile soils (OEH 2014f). The barking owl preferentially hunts small arboreal mammals such as squirrel gliders and ringtail possums, but also preys on birds, invertebrates and terrestrial mammals such as rodents and rats. Nesting generally occurs during mid-winter and spring, where two or three eggs are laid in hollows of large, old trees (OEH 2014f). These breeding places are used repeatedly over years by a pair (OEH 2014f). Eggs are generally laid in August, with fledging in November (OEH 2014f). No large hollows suitable for barking owl were observed within the study area during field surveys undertaken 27-29 April 2015.

Notwithstanding, pre-clearance fauna surveys by an ecologist would negate direct impacts on barking owls that could be using smaller hollows in the study area. The pre-clearance fauna survey/check would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain nests occupied by barking owl would be left untouched until young have fully fledged and vacated the immediate area. The proposed works are unlikely to have an adverse effect on the lifecycle of the barking owl to the extent that a viable local population of the species is likely to be placed at risk of extinction.

- b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

- c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable

- d) In relation to the habitat of a threatened species, population or ecological community:**

- i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

- i) A small number of trees bearing small hollows were recorded within the study area and would require removal as part of the CHVB works. This includes a river red gum (*Eucalyptus camaldulensis*) on the western bank of the Lachlan River, two river red gums and three grey box (*E. microcarpa*) between the Lachlan River and the Mid Western Highway.

Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. This vegetation is dominated by agricultural pasturelands and associated grasslands. The works also require the removal of approximately 30 isolated trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River, 0.2 ha of riparian vegetation mapped as Floodplain Complex, 50 mature tree plantings on Airport Road, and 50 mature tree plantings on Boundary Road.

- ii) Removal of riparian vegetation and construction of the CHVB river crossing would reduce connectivity of vegetation along the Lachlan River. However, the proposed bridge would reduce connectivity by only a minor degree, and is not likely to present a barrier to the movement of raptors. As such, the proposal is unlikely to isolate or fragment habitat for any of these threatened raptor species.
- iii) Considering the limited vegetation removal required and the extent of similar vegetation in the broader area, particularly along the riparian corridor of the Lachlan River, impacts are considered to be minor.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat declarations in force under the TSC Act at the time of assessment comprise those for:

- Gould's Petrel
- Little penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve
- Wollemi Pine

No areas of critical habitat have been declared for any threatened fauna species with the potential to occur in the Study area.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan

No Recovery Plans or Threat Abatement Plans were in place for the spotted harrier, black falcon, little eagle, square-tailed kite or barking owl at the time of assessment.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes (KTPs) relevant to terrestrial fauna are identified in Schedule 3 of the TSC Act. KTPs relevant to the proposal include:

- Clearing of native vegetation – Construction of the proposed CHVB would involve vegetation clearing and earthworks, resulting in the temporary loss of varying vegetation types along the 8.4 km route. The works require the removal of approximately:
 - 30 isolated native trees (predominately eucalypts) between the Mid Western Highway and the Lachlan River
 - 0.2 ha of riparian vegetation mapped as Floodplain Complex
 - 50 mature native tree plantings on Airport Road
 - 50 mature native tree plantings on Boundary Road.

This would reduce potential habitat for raptors that may utilise this vegetation as a nesting or hunting resource. However, the area impacted is small, and is not unique in a local or regional context. Suitable habitat resources for threatened raptors occur as contiguous riparian vegetation along the Lachlan River and in other woodland and grassland areas adjoining the proposed CHVB (Figure 6). Less impacted remnant patches of vegetation occur within the broader region which are likely better suited to raptor species.

- Loss of hollow-bearing trees – The proposed works require the removal of six trees bearing small hollows. Loss of hollow-bearing trees could reduce the availability of potential breeding habitat for raptor prey species, although is unlikely to reduce the immediate availability of potential breeding habitat for hollow-nesting raptors (e.g. barking owl) as no large hollows were detected within the study area during surveys 27-29 April 2015. Notwithstanding, pre-clearance fauna surveys would be undertaken by an ecologist to negate direct impacts on breeding places of threatened species. The pre-clearance fauna survey/check would be undertaken approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any hollow-bearing trees observed to contain an occupied nest of the barking

owl would be left untouched until young have fully fledged and vacated the immediate area.

Conclusion

The proposal would impact potential habitat for threatened raptor species through the removal of potential breeding, sheltering and hunting habitat. However, the area to be impacted is small in both a local and regional context and unlikely to represent core habitat for any of these species. Pre-clearance fauna surveys/checks would be undertaken by an ecologist approximately 1-5 days prior to clearing to identify and mitigate against direct impacts on breeding places of threatened species. Any trees observed to contain an active breeding place of a threatened raptor would be left untouched until young have fully fledged and vacated the immediate area. In conclusion, the proposal is highly unlikely to have a significant impact on threatened raptors and as such a Species Impact Statement is not required.

Appendix G: Assessments of Significance – Aquatic Fauna

Assessments of Significance – Aquatic Fauna

The EP&A Act specifies a set of seven factors which must be considered by decision-makers in assessing the effect of a proposed development or activity on threatened species, populations or ecological communities, or their habitats. These factors are collectively referred to as the '7 part test'.

In January 2007, the Australian and NSW Governments signed a Bilateral Agreement which allows the assessment regimes under the EP&A Act (Part 4 and 5 of the EP&A Act) to be automatically accredited under the EPBC Act. This means that separate assessment processes are not required. Where a proposed development is in the potential range of a listed threatened species, population or ecological community under the FM Act and/or EPBC Act, the '7 part test' applies (DPI 2013).

The following seven factors have been used to determine whether there would be a significant impact on any of the FM Act or EPBC Act listed threatened species and ecological communities (or their habitats) found to be in or likely to be using the Study area and where there is potential for the CHVB to impact on these species, including:

- Fishes
 - Silver perch (*Bidyanus bidyanus*).
 - Murray cod (*Maccullochella peelii*)
- The aquatic ecological community in the natural drainage system of the lowland catchment of the Lachlan River (Lachlan River EEC).

Fishes

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Both the silver perch and the Murray cod have the potential to occur in the Study area. The Study area may provide spawning habitat or a passage to spawning habitat for both species during the breeding season (spring/summer). Fish passage would be maintained at all times during the construction period. Cofferdams may be utilised to allow piling works to proceed whilst minimising water quality impacts. Cofferdams would be used only temporarily and would be removed following completion of piling works. Fish passage would be maintained at all times.

The proposal is not expected to create any barriers to fish migration or spawning. Vegetation removal, earthworks and piling works on the river bank have the potential to reduce water quality. In the absence of suitable controls, sedimentation and reduced water quality have the potential to influence fish movement and spawning success. Where practicable, bridge works would be scheduled to avoid spring and summer, where spawning of silver perch and Murray cod is most likely to occur. Erosion and sediment control measures would be prepared to minimise the risk of spills and sediment laden-runoff from reaching the Lachlan River.

The potential for the proposal to impact on the life cycle of the silver perch and Murray cod is low. Through the implementation of mitigation measures, the risks are further reduced. The proposal is highly unlikely to lead to an increased risk of extinction for either species.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable

c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable

d) In relation to the habitat of a threatened species, population or ecological community:

- i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

- iv) Construction of an approximate 10 m wide bridge is proposed as part of the CHVB. It is anticipated that a 20 m wide corridor of riparian zone would be impacted as part of the bridge construction. This would include the removal of willows (*Salix* spp.), native riparian vegetation, earthworks on the river bank and in stream piling. The proposed crossing site is located alongside existing infrastructure (rail bridge, overhead power lines, and an existing concrete structure / tank) and avoids less-impacted areas of riparian vegetation. Piling works would require a coffer dam or similar temporary water diversion, though this is expected to block off only approximately one third of the stream bed during piling works. Removal of snags within the waterway may be required. However, snags derived from native species (i.e. not willows) would be relocated nearby to reduce long-term degradation of fish habitat.
- v) The proposal would not fragment or isolate fish habitat. During piling there would be only a minor, temporary and short-term reduction in the amount of habitat available in the stream reach due to water diversion.
- vi) The study reach provides only marginal habitat for both the silver perch and Murray cod. Bed substrates are highly mobile and are dominated by gravel and sand. Edge habitat provides greater substrate and habitat complexity, although it does not provide unique habitat that can't be found directly upstream or downstream of the proposed works area. The study reach is highly unlikely to provide habitat fundamental to the long-term survival of either species.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

As of 13 May 2015, critical habitat in NSW has only been identified for the grey nurse shark. No areas of critical habitat have been declared for any threatened fauna species with the potential to occur in the Study area.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan

A recovery plan is in place for the silver perch (DPI 2006). The specific objectives of the recovery plan are to:

- increase awareness of the current status of silver perch throughout its range
- increase scientific knowledge of the current distribution, ecological and habitat requirements and population genetics of silver perch
- protect and enhance remaining natural populations of silver perch
- ameliorate the impacts of known major threats to silver perch
- minimise any fishing impacts on natural populations through enhanced compliance with fishing regulations and involvement of recreational fishers
- improve management of aquaculture and stocking programs
- encourage and support the involvement of indigenous communities in the implementation of recovery actions
- establish a program to monitor the status of silver perch and evaluate the effectiveness of recovery actions.

The proposal would not interfere with the objectives of the recovery plan.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes (KTPs) relevant to fisheries are identified in Schedule 6 of the FM Act. KTPs relevant to the proposal include:

- The removal of large woody debris from NSW rivers and streams – the in-stream works may require the removal of large woody debris that provides fish habitat. The in-stream works would be restricted to an approximately 20 m wide span across the channel. Consequently, only a small amount of large woody debris is likely to be impacted. Woody debris derived from native species (i.e. not willows) would be retained where possible or relocated to adjoining habitat if it is not able to remain in place.
- Degradation of native riparian vegetation along NSW water courses – riparian vegetation would be removed as part of the proposal. Riparian areas outside the development footprint would be marked as no-go areas. Weed control measures would be implemented and creek banks would be stabilised post-works with native plantings endemic to the area. The potential for degradation of riparian vegetation of the Lachlan River would be minimised.
- Installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams – the bridge construction would require the installation of in-stream structures via piling. Instream structures would permanently alter flow; however, these impacts would be minor.

Conclusion

The proposal would impact potential habitat for the silver perch and Murray cod. It is unlikely, although possible, that these species would spawn within the Study reach. More importantly, these species may transit the Study reach during their breeding season, and fish passage must be maintained throughout the works. Where possible, bridge works would also be scheduled to avoid the spawning season of spring/summer for these species. In conclusion, the proposal is highly unlikely to have a significant impact on either the silver perch or the Murray cod and as such, a Species Impact Statement is not required.

Lachlan River EEC

- a) **In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable.

- b) **In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

- c) **In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i) **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - ii) **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The Lachlan River EEC includes all native fish and aquatic invertebrates within all natural rivers, creeks, streams and associated lagoons, billabongs, lakes, wetlands, paleochannels, flood-runners, floodplains and effluent streams of the Lachlan River (DPI 2006). The community includes 19 species of fish, 10 species of crustacean, 8 species of mollusc, 2 species of sponges, and many insects. The aquatic ecosystem of the lower Lachlan River catchment has been greatly modified since European settlement, by river regulation, agricultural land uses and the introduction of non-native species. Species have declined in their numbers and distribution, some to the point where they are now listed as threatened (DPI 2006).

- i) Construction of an approximate 10 m wide bridge is proposed as part of the CHVB. It is anticipated that a 20 m wide corridor of riparian zone would be impacted as part of the bridge construction. Impacts to the Lachlan River EEC include removal of willows (*Salix* spp.), removal of native riparian vegetation, earthworks on the river bank, temporary water diversion and instream bridge piling. Furthermore, the works have the potential to degrade water quality in the absence of mitigation measures for spills and sedimentation. Potential impacts are expected to be transient, minor and over a small area. As such, the propose works are not expected to place this EEC at risk of extinction.
- ii) The proposal would clear approximately 0.2 ha of largely degraded riparian vegetation along the Lachlan River. The works provide an opportunity to remove willows (*Salix* sp.), which currently dominate the proposed impact footprint. Furthermore, native, endemic species would be planted as part of the works to help recolonise the river banks, assisting in both bank stability and habitat connectivity. Instream habitat alteration would be over a small area and minor in nature. The works are not expected to adversely alter aquatic flora and fauna assemblages.

d) In relation to the habitat of a threatened species, population or ecological community:

- iv) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

- i) The area of riparian vegetation to be impacted is approximately 0.2 ha. Disturbed areas would be rehabilitated with native plantings of endemic species. In-stream habitat would be altered by the installation of bridge piers. Additionally, large woody debris may need to be removed. The area of instream habitat to be impacted is expected to be in the order of 60 m channel width x 10 m bridge width.
- ii) The proposal would not fragment or isolate areas of habitat for this EEC.
- iii) The proposed Lachlan River crossing location has been subject to numerous past disturbances, including clearing associated with the rail bridge, construction of a concrete pit/structure and overhead powerlines, as well as grazing, human visitation, rubbish dumping and weed ingress. The proposed crossing location is contained to previously disturbed areas of the riparian corridor. The EEC occurs across a very large area and the Study area is not known to contain any unique natural habitat features and is unlikely to be of critical importance to the long-term survival of the Lachlan River EEC.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

As of 13 May 2015, critical habitat in NSW has only been identified for the grey nurse shark. No areas of critical habitat have been declared for any constituent species of this EEC.

f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan

No Recovery Plans have been prepared for the Lachlan River EEC.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Key threatening processes (KTPs) relevant to fisheries are identified in Schedule 6 of the FM Act. KTPs relevant to the proposal include:

- The removal of large woody debris from NSW rivers and streams – the in-stream works may require the removal of large woody debris that provides fish habitat. The in-stream works would be restricted to an approximately 20 m wide span across the channel. Consequently, only a small amount of large woody debris is likely to be impacted. Woody debris derived from native species (i.e. not willows) would be retained where possible or relocated to adjoining habitat if it is not able to remain in place.
- Degradation of native riparian vegetation along NSW water courses – riparian vegetation would be removed as part of the proposal. Riparian areas outside the development footprint would be marked as no-go areas. Weed control measures would be implemented and creek banks would be stabilised post-works with native plantings

endemic to the area. The potential for degradation of riparian vegetation of the Lachlan River would be minimised.

- Installation and operation of in-stream structures and other mechanisms that alter natural flow regimes of rivers and streams – the bridge construction would require the installation of in-stream structures via piling. Instream structures would permanently alter flow; however, these impacts would be minor.

Conclusion

The proposal would impact the Lachlan River EEC through loss of riparian vegetation, potential removal of instream habitat, and potential water quality degradation. However, potential impacts are transient and confined to a relatively small, largely disturbed area. Impacts would be reduced through implementing of mitigation measures such as retaining woody debris, erosion and sediment controls and rehabilitation with native plantings. In conclusion, the proposal is highly unlikely to have a significant impact on the Lachlan River EEC and as such, a Species Impact Statement is not required.